

3.7 DRAWING AND DESIGN (449)

The Drawing and Design examination for 2012 consisted of two papers namely Paper 1, a theory and Paper 2, a practical paper. The theory paper constituted **60%** while the practical paper constituted **40%** of the final mark. The revised syllabus was tested for the first time with the format and weighting changed for paper 1. The format and weighting for paper 2 was the same as for the previous years.

Candidates' Overall Performance

Table 14: *Candidates' Overall performance for the Years 2008, 2009, 2010, 2011 and 2012*

Year	Paper	Candidature	Maximum score	Mean score	Standard Deviation
2008	1		60	20.42	10.51
	2		40	26.16	5.87
	Overall	19	100	46.58	15.44
2009	1		60	26.31	13.12
	2		40	20.44	7.53
	Overall	313	100	46.75	18.49
2010	1		60	27.93	12.09
	2		40	22.22	6.49
	Overall	307	100	50.15	14.79
2011	1		60	31.52	10.17
	2	428	40	24.17	7.00
	Overall		100	55.68	15.21
2012	1		60	32.61	11.67
	2	420	40	27.17	5.62
	Overall		100	59.79	15.59

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

- (i) The candidature decreased from 428 in 2011 to 420 in 2012.
- (ii) The mean score for paper 1 increased from 31.52 to 32.61 while that of paper 2 increased from 24.17 to 27.17
- (iii) The combined mean score increased from 55.68 to 59.79 showing an improvement in performance.

3.7.1 Drawign and Design Paper 1 (449/1)

The following analysis examines individual questions where poor performance was recorded in the paper. The questions include **1, 3, 5, 6, 7, 11, 14**.

Question 1(a)

Give the following information regarding parastatal organizations in Kenya with respect to:

- (i) Ownership
- (ii) Management
- (iii) Services

Candidates were tested on information regarding parastatals in Kenya which falls under the topic career information.

Weakness

Most candidates were unable to differentiate between parastatals and private companies.

Advice to Teachers

They should teach all the topics in the syllabus without assuming any.

Expected responses

- i. Ownership- they are largely owned by the government
- ii. Management- they are managed by government appointees
- iii. Services –they provide services to the customers who find it expensive to afford them if they are left to private establishments.

Question 3 (b)

Describe each of the following manufactured boards:

- (i) Plywood
- (ii) Chip board
- (iii) Block board

Most candidates were not able to answer this question.

Advice to Teachers

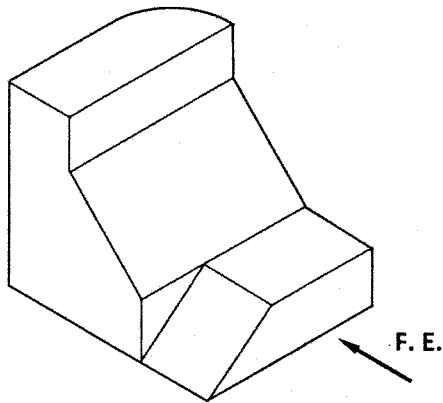
They should organize for education trips to industries where these boards are manufactured to expose students to these boards.

Expected responses

- (i) Ply woods are made thin sheets of wood (veneers) that are glued together with the grain of each layer perpendicular to the next.
- (ii) Chipboards are manufactured by compressing chips of wood which are then glued to the required density.
- (iii) Block boards are made up of blocks of timber joined on edge and faced suitably with plywood on both faces.

Question 5

Figure 2 shows a pictorial view of a block.



Using third angle projection, sketch in good proportion the orthographic views of the block.

The question tested the candidates on the skill of interpreting from pictorial to orthographic projection.

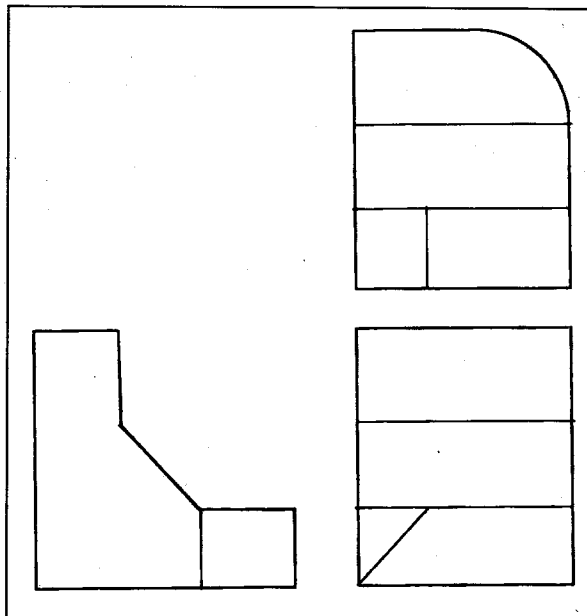
Weakness

Some candidates could not differentiate between first angle and third angle projection.

Advice to Teachers

They should give students more questions to practice on orthographic projection.

Expected responses



Question 6

Figure 3 shows two views of a block drawn in first angle projection. In good proportion sketch the block in oblique projection.

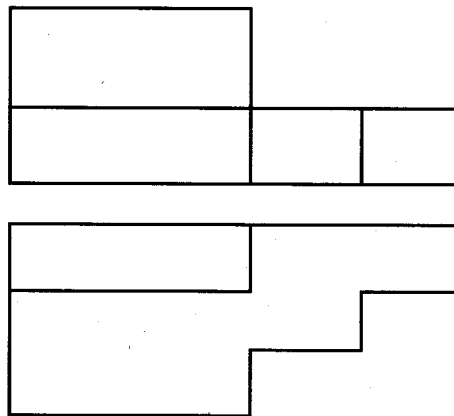


Figure 3

Candidates were expected to sketch in good proportion the oblique view of a block whose two views were given in first angle orthographic projection.

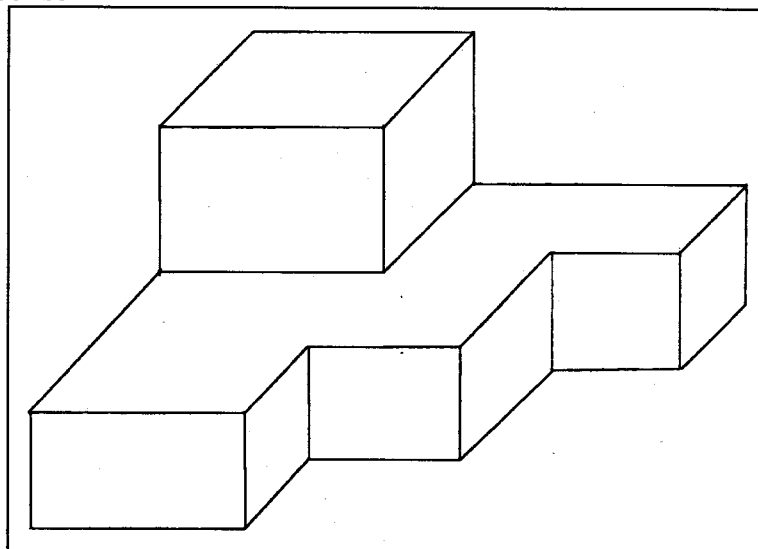
Weakness

Some candidates confused between first angle and third angle projection while some mixed up the angle for the receding side.

Advice to teachers

They should teach pictorial drawings thoroughly and explain to the students the differences between oblique and isometric drawings with the aid of drawings.

Expected response



Question 7

Construct an internal common tangent to the circles given in figure 4

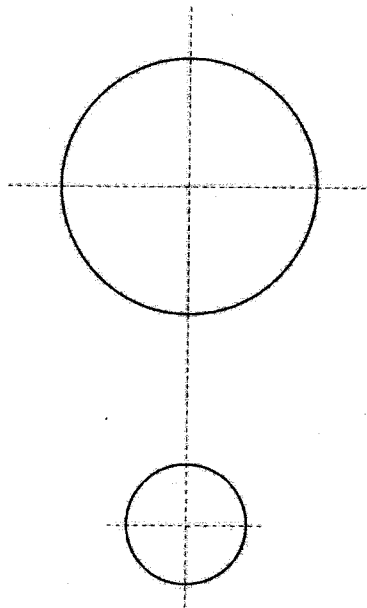


Figure 4

Candidates were tested on the construction of an internal common tangent to the circles as given in the question.

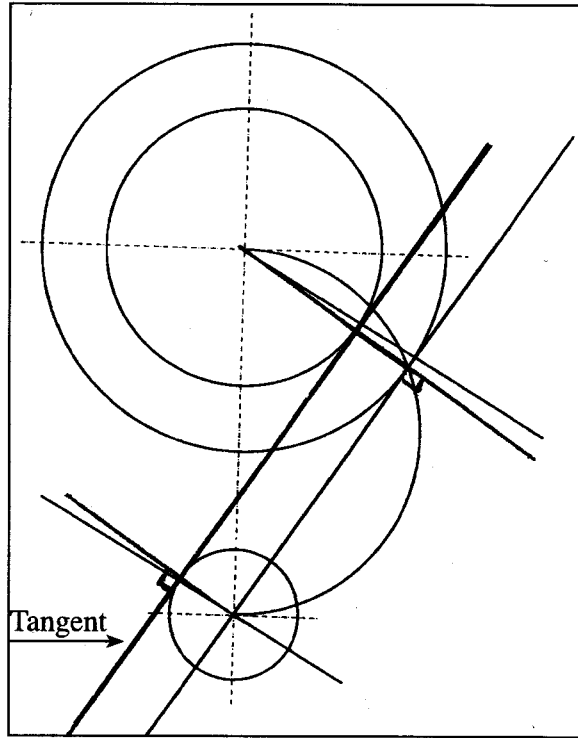
Weakness.

Some candidates confused between internal and external tangent.

Advice to Teachers

They should give students more questions on construction of tangents for practice.

Expected Response:

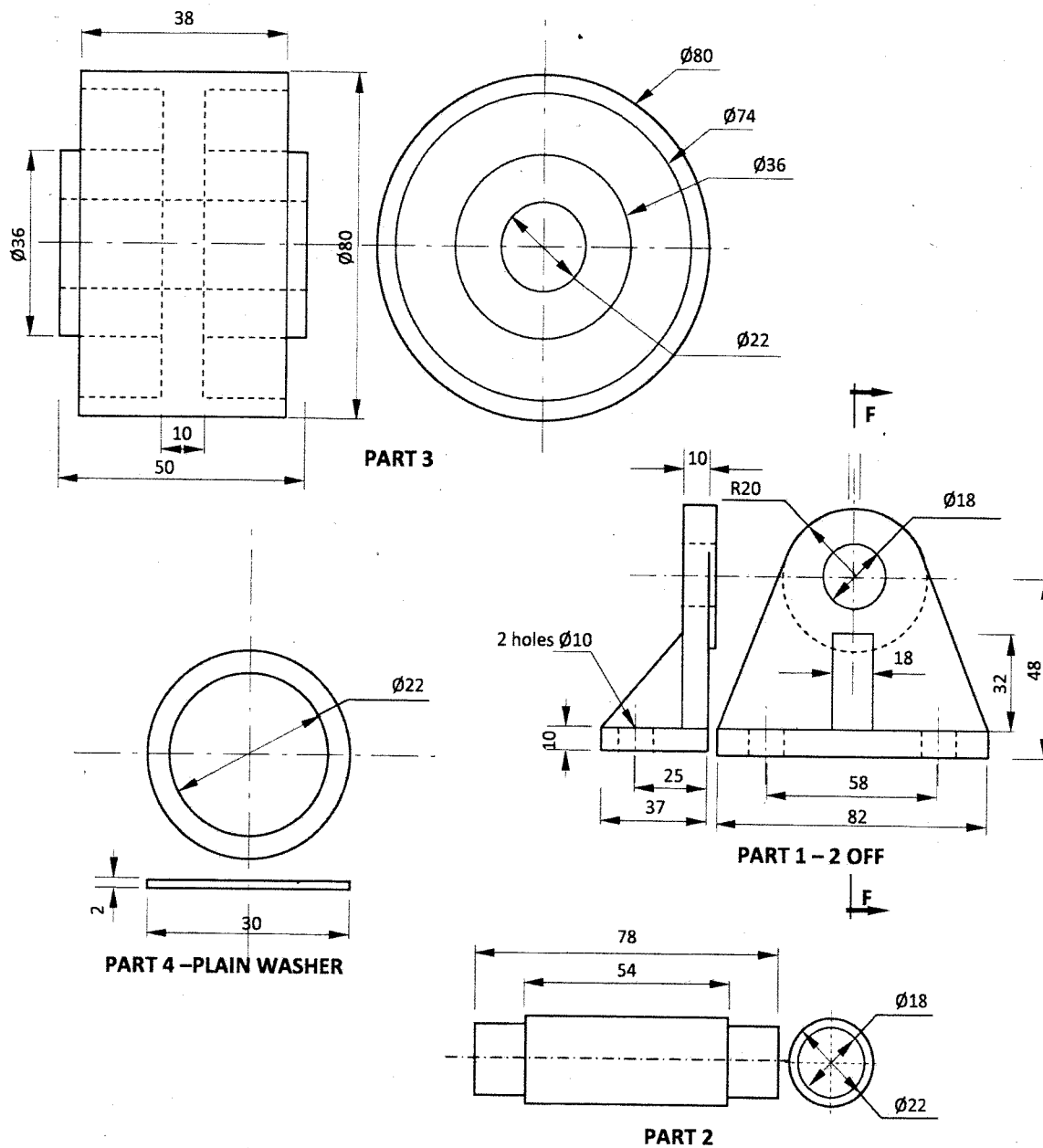


Question 11

Figure 7 shows parts of a machined component drawn in first angle projection.

Assemble the parts and draw the following:

- a) Sectional front elevation through the cutting plane F-F
- b) The plan



Candidates were expected to assemble parts of a machined component drawn in first angle projection and draw a sectional view and the plan of the assembly.

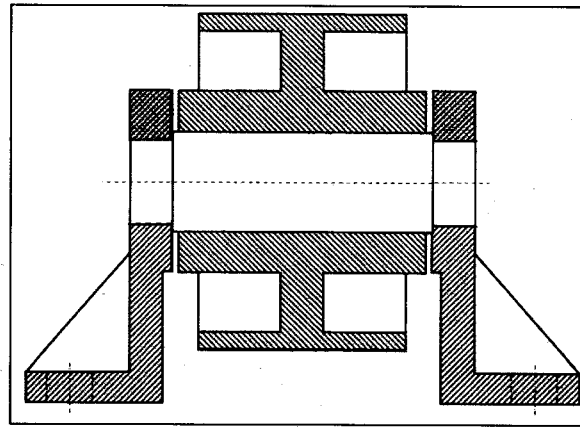
Weakness

Most candidates had problems assembling the component and drawing the required views.

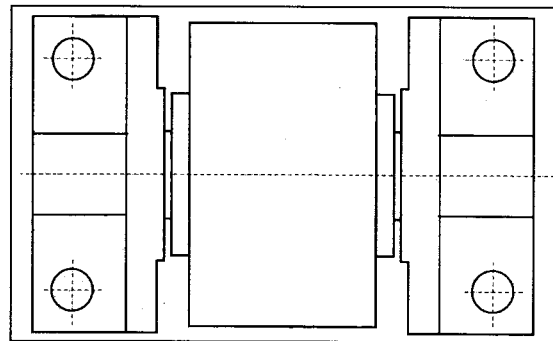
Comment

Teachers are advised to give students more practice in assembly drawing emphasizing on the correct sectioning of the cut portions which indicates the internal construction of a given component. This aspect in drawing is very vital as it enables the students to visualize the internal construction of given components.

Expected Responses.



SECTIONAL FRONT ELEVATION ALONG F-F



PLAN Figure

Question 14

Figure 10 shows a branch pipe A connected to a conical shaped base of a chimney B.

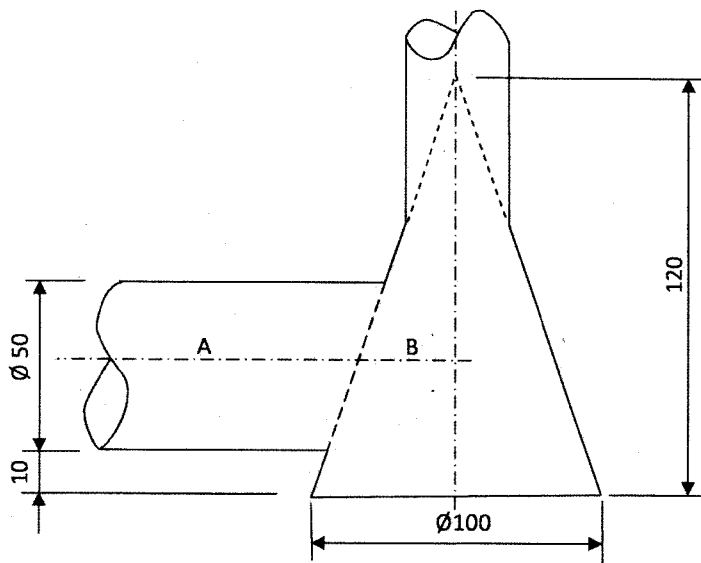


Figure 10

Draw the curves of interpenetration between the pipe and the conical base in:

- a) Plan
- b) Elevation

Candidates were tested in drawing the curves of interpenetration between different solids.

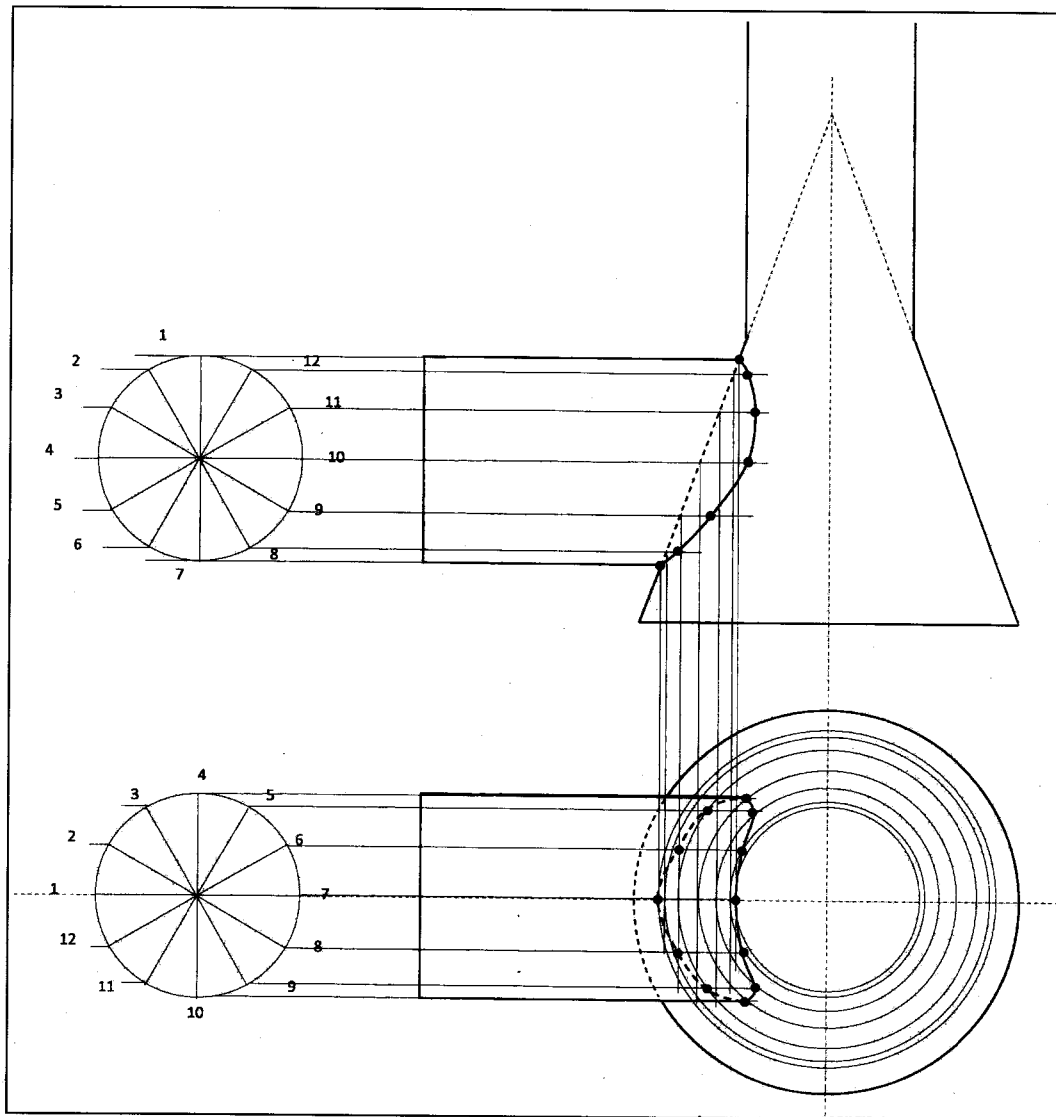
Weakness

Some candidates were unable to complete the question while most of them did not attempt the question.

Advice to Teachers

They should give students more practice on drawing the curves of interpenetration between different solids.

Expected Responses



3.7.2 Drawing and Design Paper 2 (449/2)

This paper is always composed of one design question which must be attempted by all candidates. In the year 2012, the question required the candidates to design a device to hold several hanging lines with the following considerations:

- It should be collapsible for ease of movement and storage.
- It should be stable and strong enough to hold clothes to dry.
- It should be adjustable to different heights

In their responses, the candidates were expected to present rough sketches of two possible designs. In the second requirement, the candidates were to select one of the two possible designs and refine it into an exploded pictorial sketch.

The third requirement called for the candidates to make detailed sketches of suitable mechanisms to cater for each considerations cited above.

In the fourth requirement candidates were expected to list materials used in the device and state the reason for their choice.

In the fifth requirement candidates were to list two methods used to join the parts.

Weaknesses

The following weaknesses were observed in candidate's work.

- (i) Presenting detailed exploded sketches to show various considerations.
- (ii) Drawing clear refined pictorial sketches.
- (iii) Making detailed exploded sketches to show suitable mechanisms.
- (iv) Differentiating between different materials used in design
- (v) Identifying different methods of joining different parts.

Advice to Teachers

- (i) Teach the students different types of designs and allow them to come up with sophisticated designs of their own.
- (ii) Engage the students in drawing refined pictorial sketches.
- (iii) Give students enough questions to practice on drawing exploded views of different designs.
- (iv) Teach the students different materials and expose them to commonly used materials.
- (v) Teach the entire syllabus including topics like materials and methods of joining different parts of objects.

4.7 DRAWING AND DESIGN (449)

4.7.1 Drawing and Design Paper 1 (449/1)



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SECTION A (50 marks)

*Answer **all** the questions in this section in the spaces provided.*

- 1** (a) Give the following information regarding parastatal organizations in Kenya with respect to:
- (i) ownership; (1 mark)
 - (ii) management; (1 mark)
 - (iii) services; (1 mark)
- (b) Describe **four** main steps involved in design process. (4 marks)
- 2** (a) (i) State **one** reason for using different types of lines in drawing. (1 mark)
- (ii) Explain **one** use of each of the following lines:
- _____
- _____
- (1 mark)
- (b) Outline **six** advantages of using computers in drawing. (3 marks)
- 3** (a) State **one** disadvantage of using each of the following items to hold paper on the drawing board.
- (i) masking tape; (1 mark)
 - (ii) thumb pins. (1 mark)
- (b) Describe each of the following manufactured boards:
- (i) plywood; (1 mark)
 - (ii) chip board; (1 mark)
 - (iii) blockboard. (1 mark)

4 Figure 1 shows a template drawn full size.

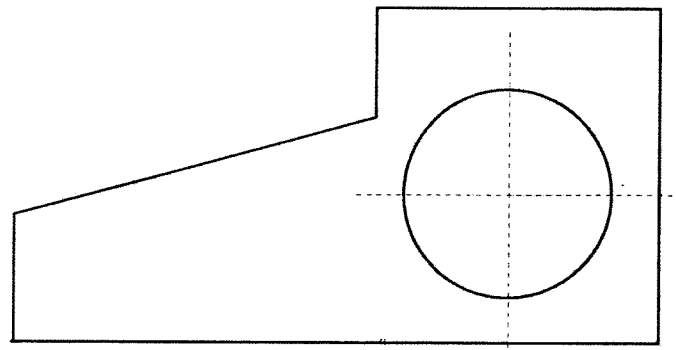


Figure 1

Measure and dimension the hole and angle of the slanting face.

(2 marks)

5 Figure 2 shows a pictorial view of a block.

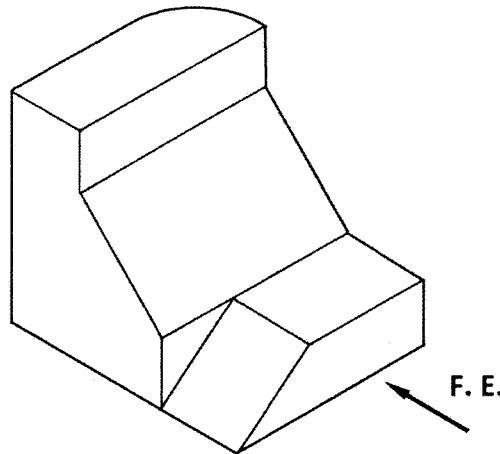


Figure 2

Using third angle projection, sketch in good proportion the orthographic views of the block.

(6 marks)

6. Figure 3 shows two views of a block drawn in first angle projection. In good proportionality sketch the block in oblique projection.

(6 marks)

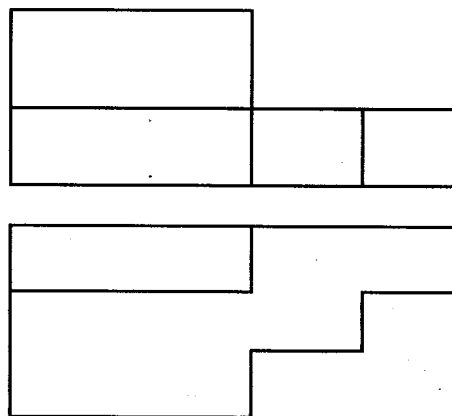


Figure 3

7 Construct an internal common tangent to the circles given in figure 4.

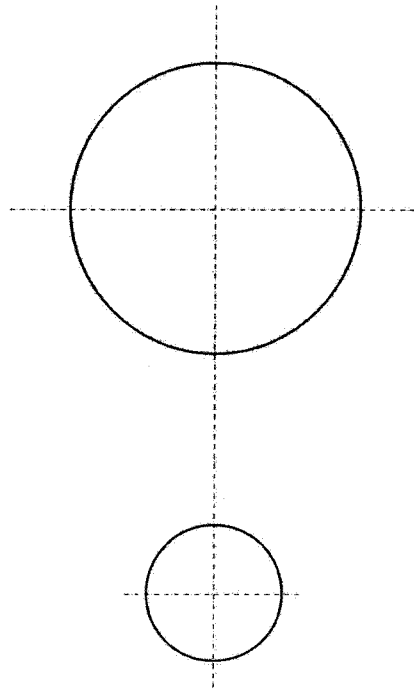


Figure 4

(7 marks)

8 The following lines were drawn using different scales.

(a) A _____ B

(b) C _____ D

Determine the distance represented by each line using the given scale. (3 marks)

(i) Line AB if the scale used is 1:2

(ii) Line CD if the scale used is 2:1.

- 9 A right square pyramid is truncated along X-X and Y-Y as shown in figure 5.

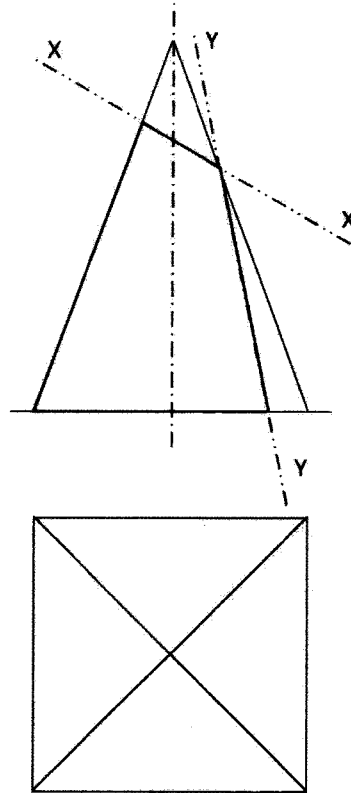


Figure 5

Complete the plan.

(4 marks)

- 10 Figure 6 shows two views of a shaped block drawn in first angle projection. Sketch the third view by projecting from the given views.

(5 marks)

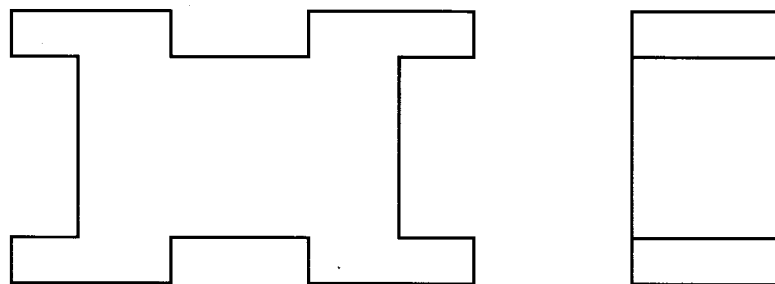


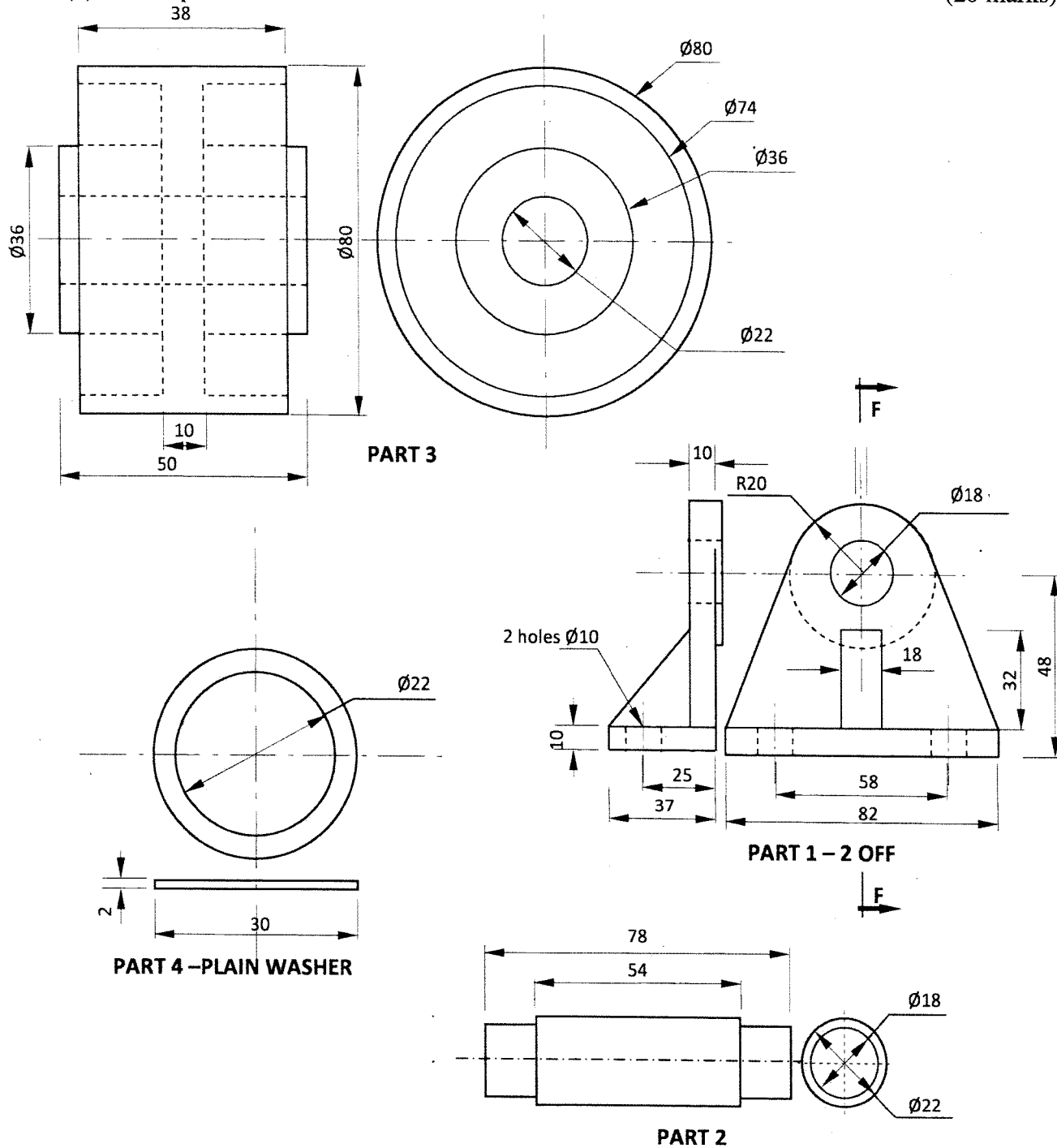
Figure 6

SECTION B (20 marks)
This question is compulsory.

11 Figure 7 shows parts of a machined component drawn in first angle projection. Assemble the parts and draw the following:

- (a) sectional front elevation through the cutting plane F-F;
- (b) the plan.

(20 marks)



SECTION C (30 marks)

Answer any two questions from this section.

- 12** Figure 8 shows the three orthographic views of a machined block drawn in first angle projection. Draw full size, the isometric view of the block taking corner **X** as the lowest point. (15 marks)

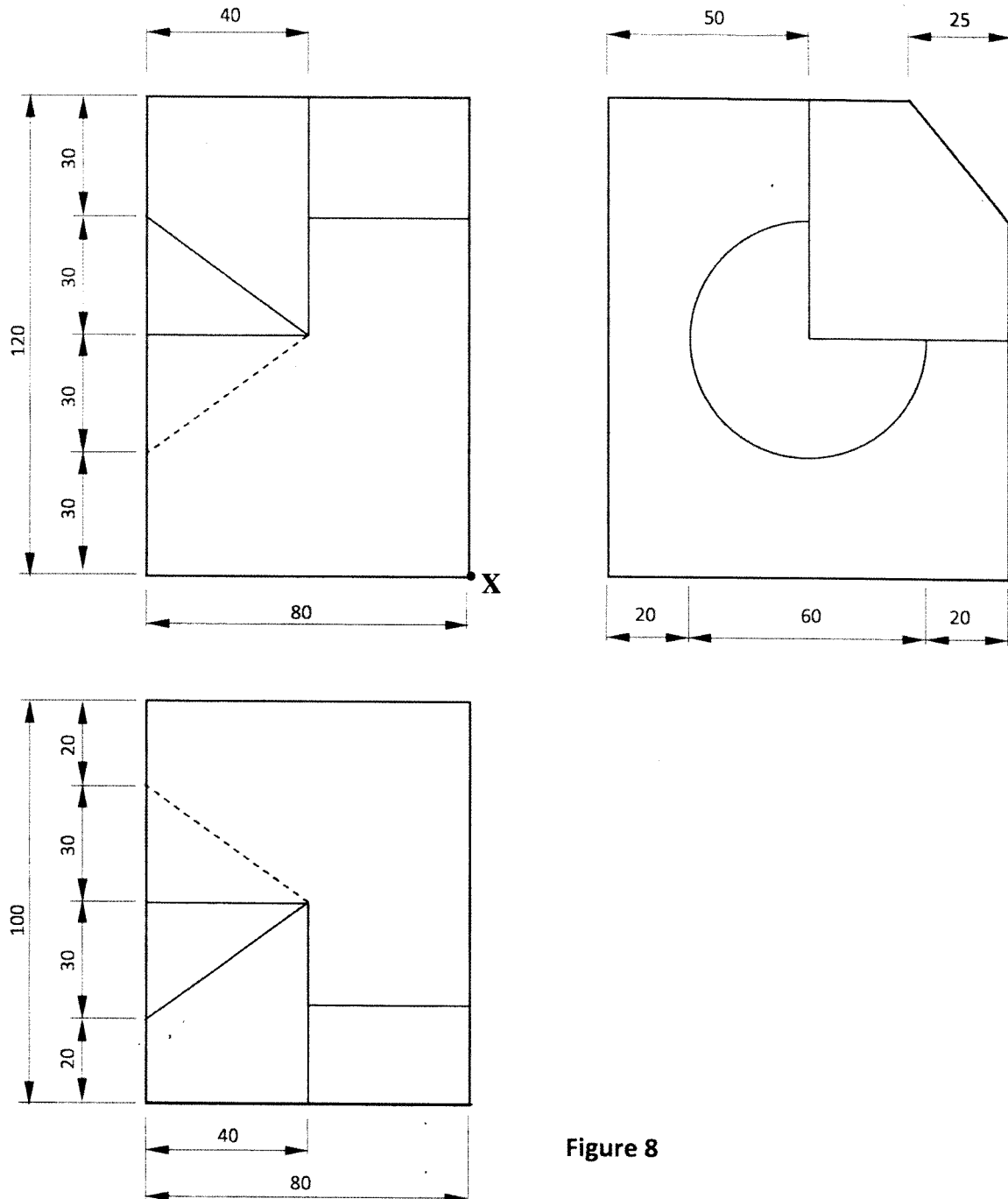


Figure 8

13 In the mechanism shown in figure 9, the crank EF rotates about centre E while GH oscillates about G.

Plot the locus of point P for one complete revolution of EF.

(15 marks)

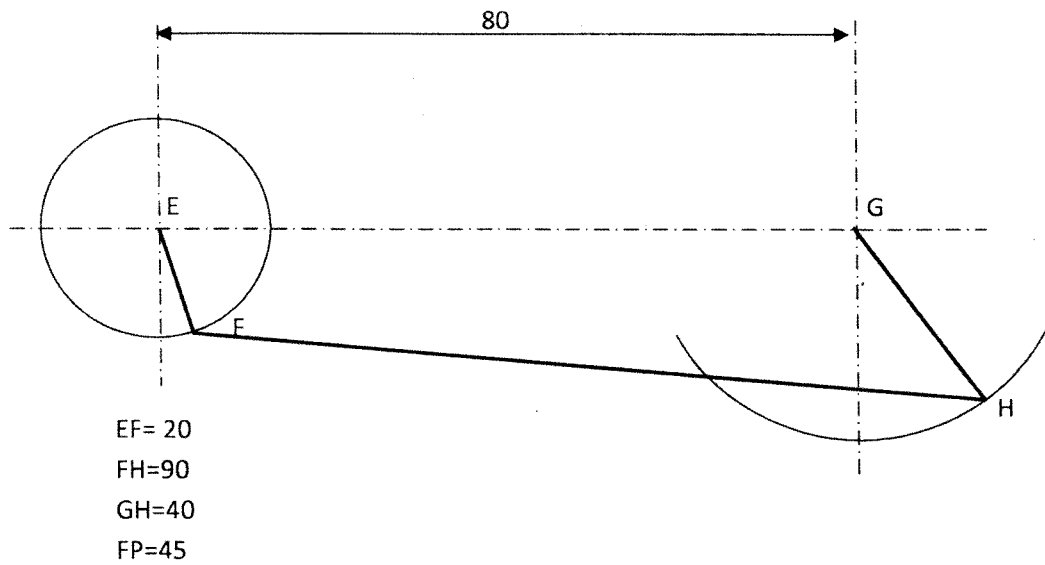


Figure 9

14 Figure 10 shows a branch pipe A connected to a conical shaped base of a chimney B.

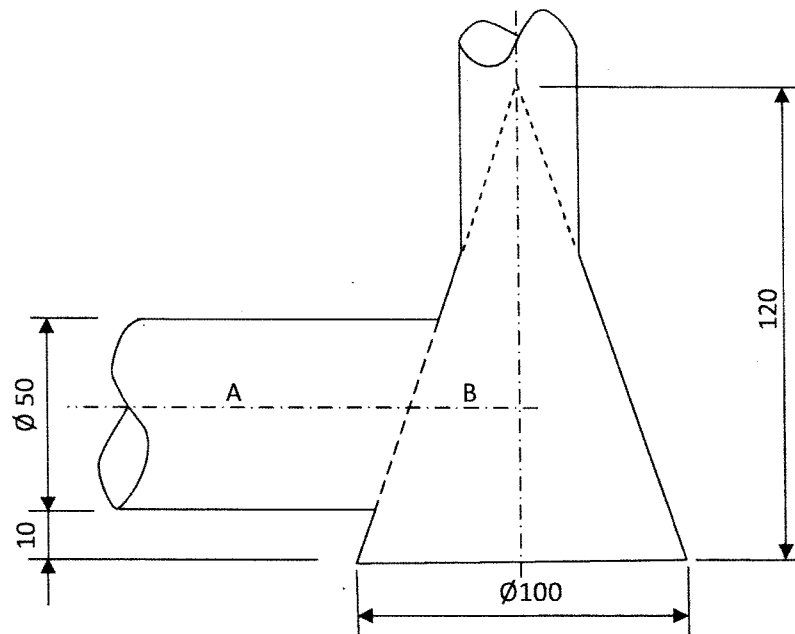


Figure 10

Draw the curves of interpenetration between the pipe and the conical base in:

- (a) plan
- (b) elevation.

(15 marks)

4.7.2 Drawing and Design Paper 2 (449/2)

DESIGN PROBLEM (40 marks)

Urban lifestyle may not provide adequate outdoor space for cloth lines. This compels the house occupants to utilize any available space inside the house to hang washed clothes to dry.

Design a suitable device that can hold several hanging lines considering the following:

- (i) the device should be collapsible for ease of movement and storage;
- (ii) it should be stable and strong enough to hold clothes to dry;
- (iii) it should also be adjustable to different heights.

REQUIREMENTS

- (a) Make freehand pictorial sketches of **two** possible designs of the device. (6 marks)
- (b) Select one of the designs in (a) above and make a refined pictorial sketch and label two parts. (16 marks)
- (c) Make detailed exploded sketches of the mechanisms used in considerations i and iii above. (12 marks)
- (d)
 - (i) List **two** different materials used in the device.
 - (ii) State **one** reason for the choice of each material. (3 marks)
- (e) List **two** methods that could be used in joining the parts of the device and state where each is applied. (3 marks)



5.7 DRAWING AND DESIGN (449)

5.7.1 Drawing and Design Paper 1 (449/1)



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SECTION A

1. (a) Information regarding parastatal organizations in Kenya:
- (i) Ownership
They are largely owned by the government.
 - (ii) Management
They are managed by government appointees.
 - (iii) Services
They provide subsidized services to the customers who might find it expensive to afford them if they were left to private establishments.
- (3 x 1 = 3 marks)*
- (b) Steps involved in the design process:
- (i) Statement/stating the problem.
 - (ii) Recording the design ideas in form of sketches and written notes.
 - (iii) Selecting the best solution.
 - (iv) Preparing the final drawing or mock-up (model).
- (4 x 1 = 4 marks)*
2. (a) (i) Reasons for using different types of lines in drawing:
- It makes the drawings neat and legible.
 - It makes it easy for the person/people depending on the drawing to interpret the details in the drawing.
- (1 x 1 = 1 mark)*
- (ii) Use of the following lines:
-  centre line denoting:-
 - centre of a circle
 - axis of symmetry
 -  phatom to denote:-
 - folding line
 - different possible positions
- (2 x $\frac{1}{2}$ = 1 mark)*
- (b) Advantages of using computers in drawing:
- (i) There is higher speed in production of drawings thus saving time.
 - (ii) There is high degree of accuracy.
 - (iii) It is easy to retrieve information.
 - (iv) It is easier to make alterations on the drawings.
 - (v) It allows for interfacing/interlinking.
 - (vi) It allows for production of many copies.

(vii) The drawings produced are neat.

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

3. (a) Disadvantages of using:

- (i) Masking tape to hold paper
 - it tends to peel off part of the paper
- (ii) Thumb pins to hold paper
 - they ruin the surface of the drawing board

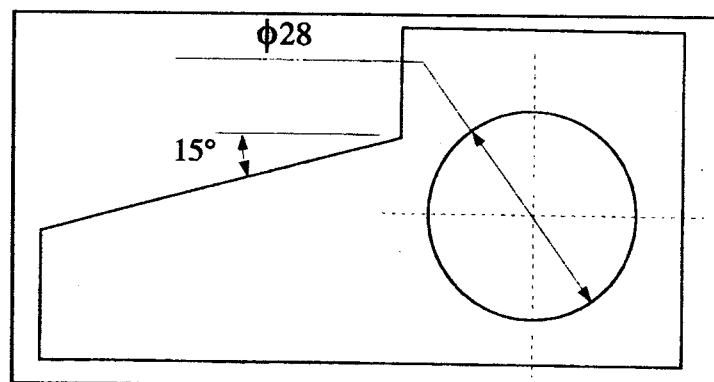
(2 x 1 = 2 marks)

- (b) (i) Plywood are manufactured boards made of thin sheets of wood (veneers) that are glued together with the grain of each layer perpendicular to the next.
- (ii) Chipboard is manufactured by chips of wood which are compressed and glued to the required density.
- (iii) Blockboards are made up of blocks of timber joined on edge and faced suitably with plywood on both faces.

Sketches to be accepted.

(3 x 1 = 3 marks)

4.

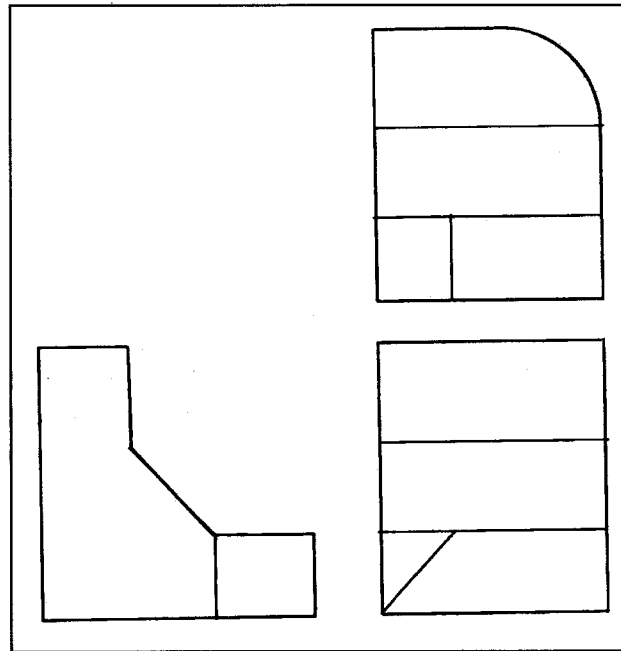


Figure

- Correct $\phi 28$ - $\frac{1}{2}$ mark
- Correct 15° - $\frac{1}{2}$ mark
- Correct arrows² for $\phi 28$ - $\frac{1}{2}$ mark
- Correct arrows for 15° - $\frac{1}{2}$ mark

(2 marks)

5.



Figure

Plan - 4 faces @ $\frac{1}{2} = 2$

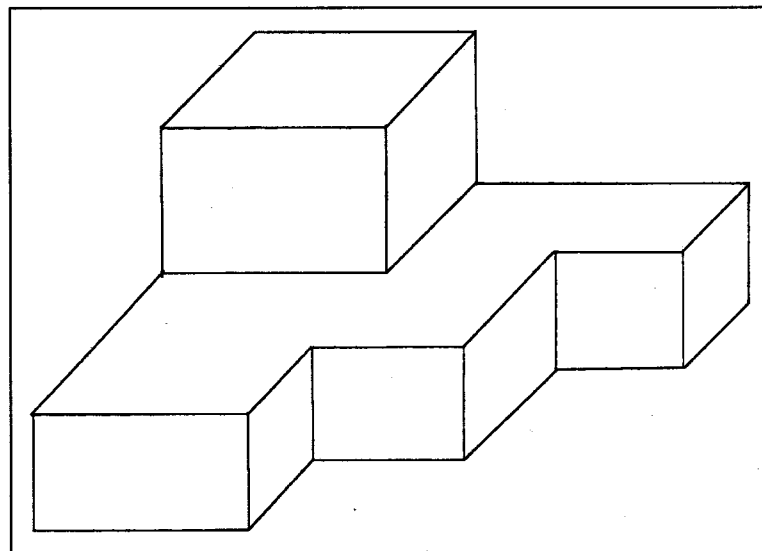
End elevation - 2 faces @ $\frac{1}{2} = 1$

Front elevation - 4 faces @ $\frac{1}{2} = 2$

3rd angle projection = 1 mark

(6 marks)

6.



Figure

Oblique projection - 1 mark

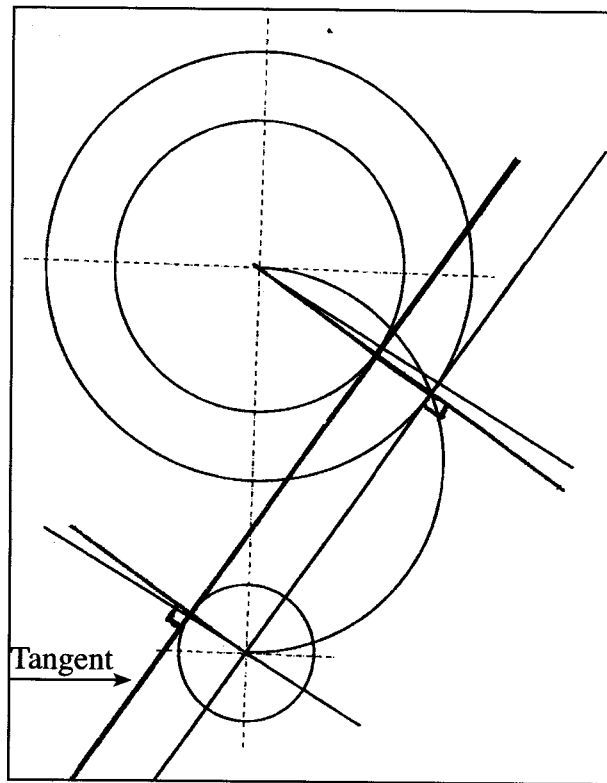
At least 9 faced 9/3 - 3 marks

Proportionality - 1 mark

Line mark - 1 mark

(6 marks)

7.



Figure

Construction of:-

Correct circle radius

R1 + R2 - 2 marks

semi-circle - 2 marks

parallel lines - 2 marks

tangent (shown correctly) - 1 mark

(7 marks)

8. AB = measured dimension x 2 $60 \times 2 = 120\text{mm}$ $1 \frac{1}{2}$
- CD = measured dimension x $\frac{1}{2}$ $34 \times \frac{1}{2} = 17\text{mm}$ $1 \frac{1}{2}$

3 marks

OR

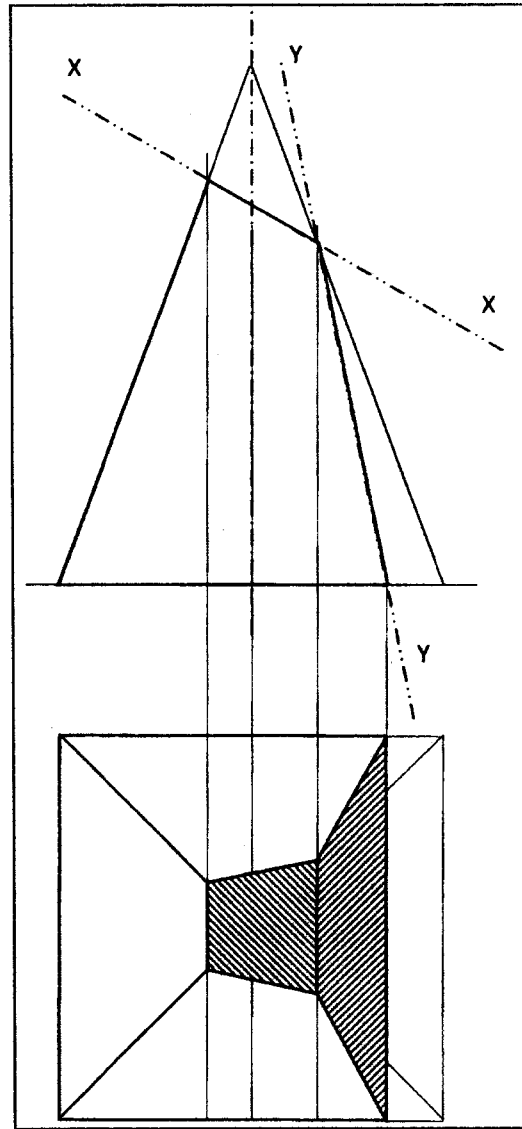
Correct measurements of AB and CD
Determining the distances

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

(2 x 1 = 2 marks)

3 marks

9.



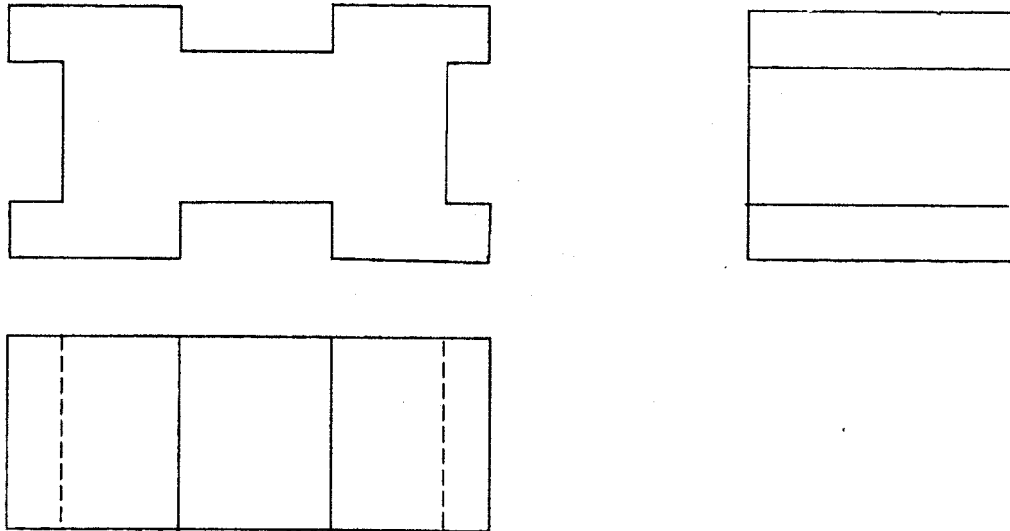
Figure

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

$$\text{Hatching} (2 \times \frac{1}{2}) = 1$$

$$\text{Line work} = \frac{1}{2}$$

10.



Figure

Vertical projection lines - 1 mark
Projection lines at 45° - 1 mark
or by use of compass
correct outline - 2 marks
hidden details - 1 mark

(5 marks)

11.

Section FF

16 faces @ $\frac{1}{4}$ = 4 marks

Hatching 6x1 = 6 marks

Plan

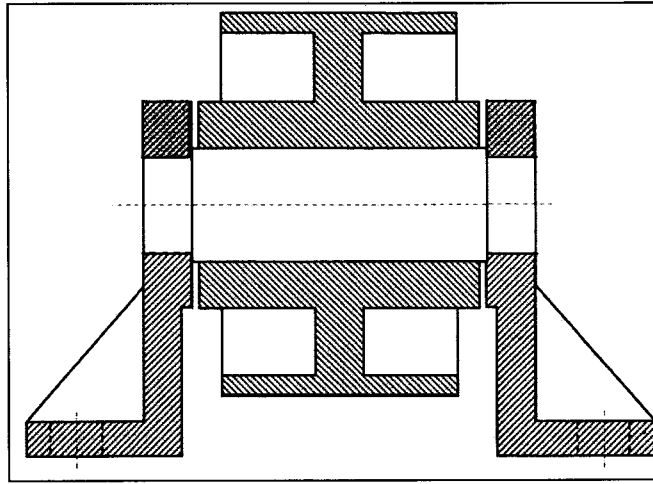
13 faces @ $\frac{1}{2}$ = 6 $\frac{1}{2}$

4 holes @ $\frac{1}{2}$ = 2

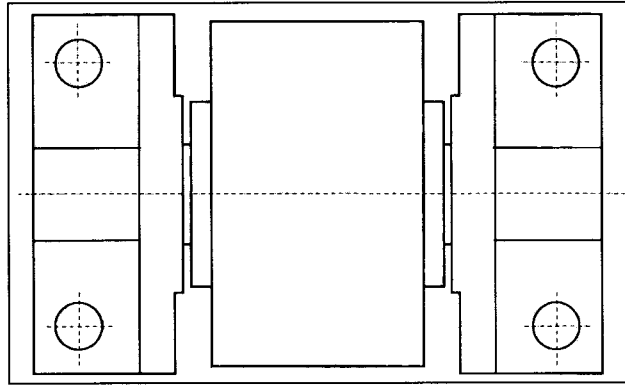
linework = 1 $\frac{1}{2}$

20 marks

11.

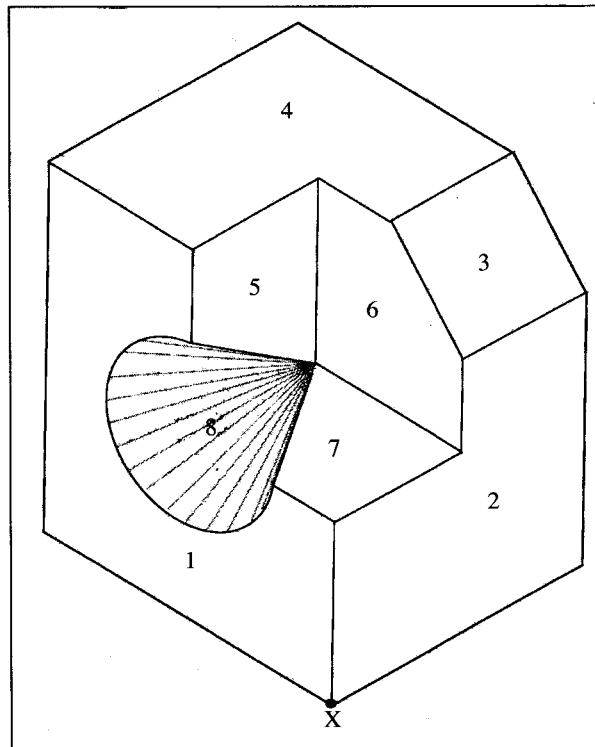


SECTIONAL FRONT ELEVATION ALONG F-F



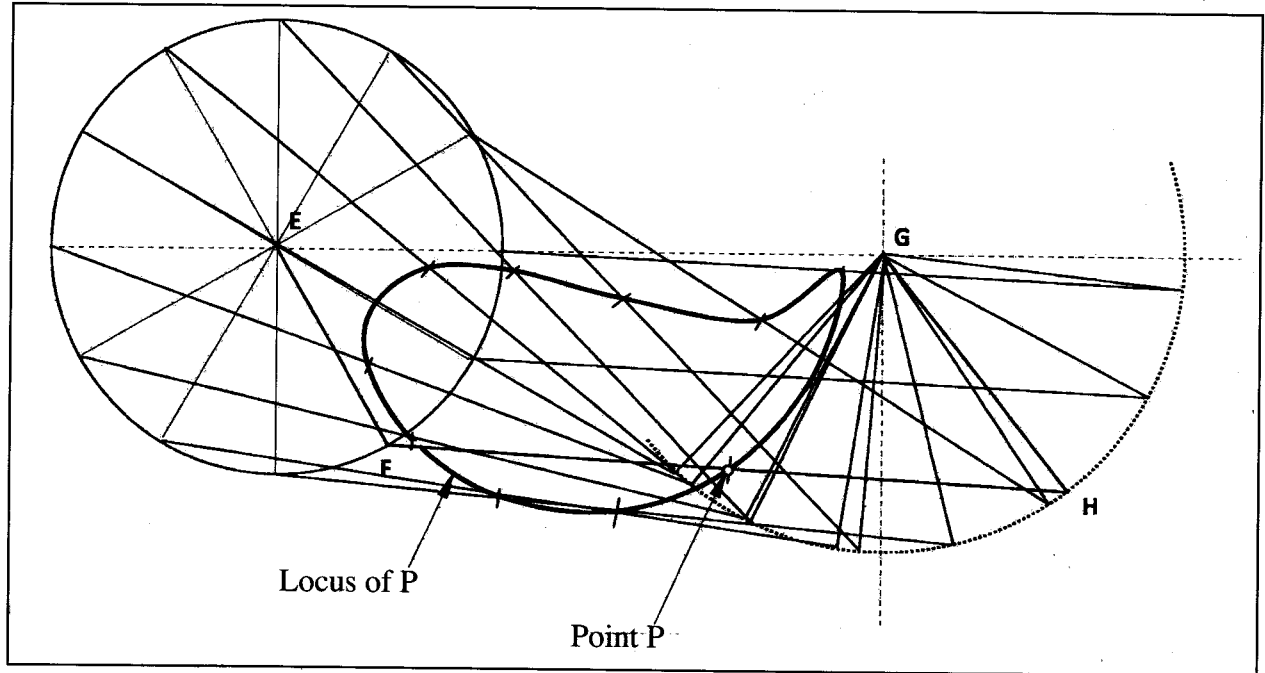
PLAN Figure

12.



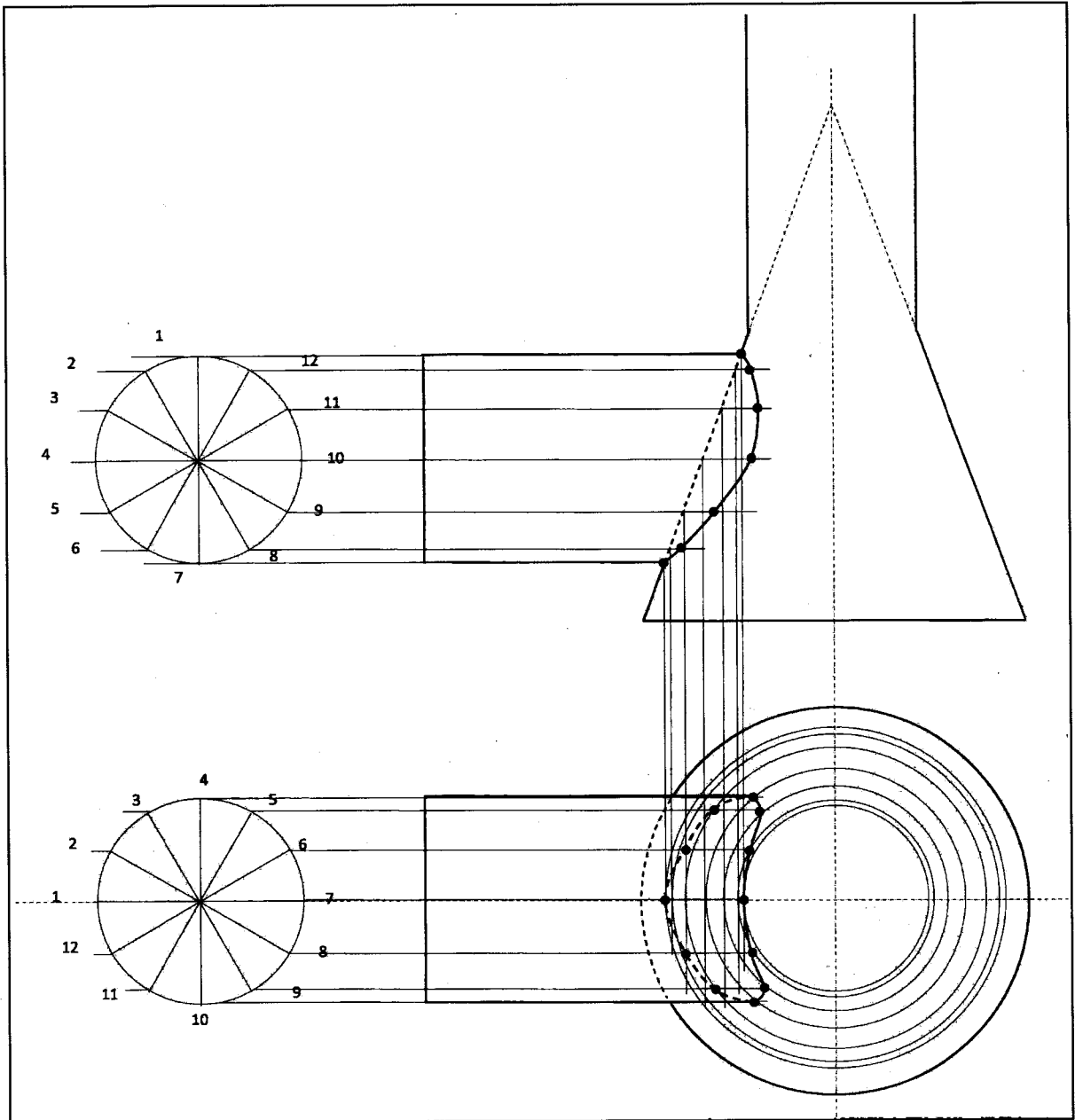
faces $7 \times 1 = 7$
 isometric axis = 1
 low pitch X = 1
 pictorial curve = 2
 conical hole (8) = 2
 scale = 1
 linework = 1
 (15 marks)

13.



copying the figure $(4 \times \frac{1}{2}) = 2$
 locus of F = 1
 division of locus F = 2
 locus of H = 1
 projection to H = 3
 mid-point P = 3
 completing locus of P = 2
 linework = 1
 (15 marks)

14.

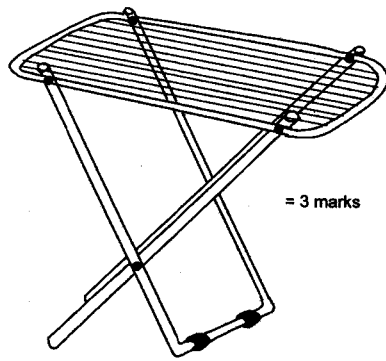


- drawn elevation = 1
- drawn plan = 2
- divide pipe in elevation = 1
- plot points at intersection of sloping edges = 1
- project elevation points to plan = 1
- draw circles at intersection of plan points and elevation points = 1
- mark curve of interpenetration points of plan = 2
- mark points of interpenetration on elevation = 2
- draw smooth curve through points of plan;
part full lines; part hidden details = 1
- draw smooth curve through points of elevation = 1
- construct lines = 1
- outlines = 1

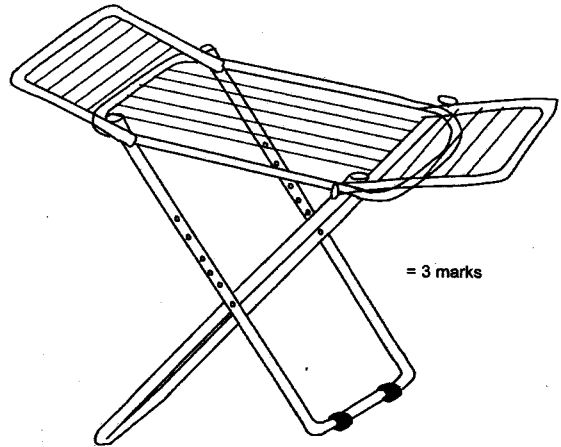
(15 marks)

4.20.2 Drawing and Design Paper 2 (449/2)

a)



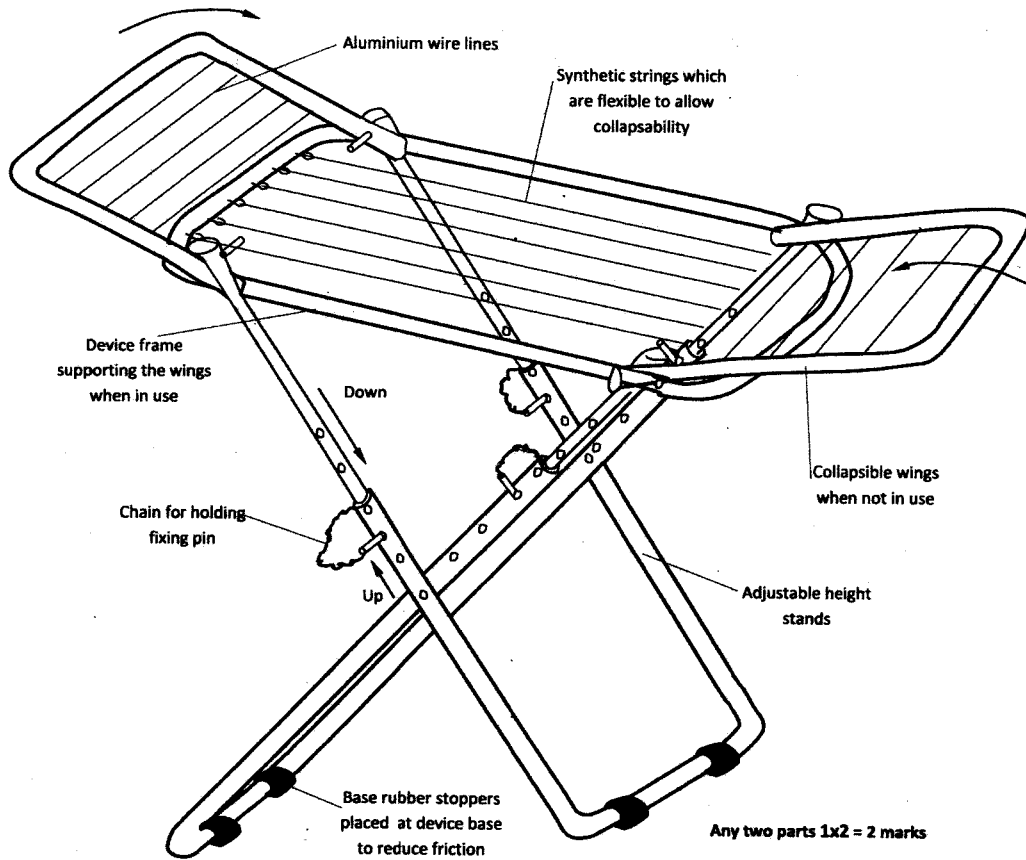
= 3 marks



= 3 marks

Total = 6 marks

b)



Any two parts 1x2 = 2 marks

Pictorial sketch = 14 marks

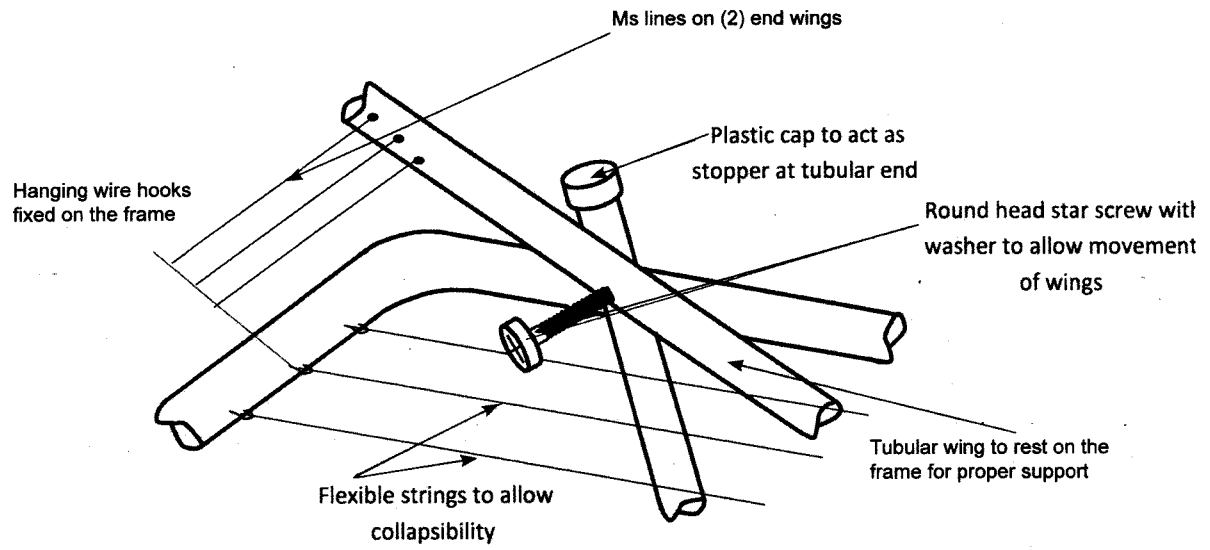
Total = 16 marks

(c)

Consideration i

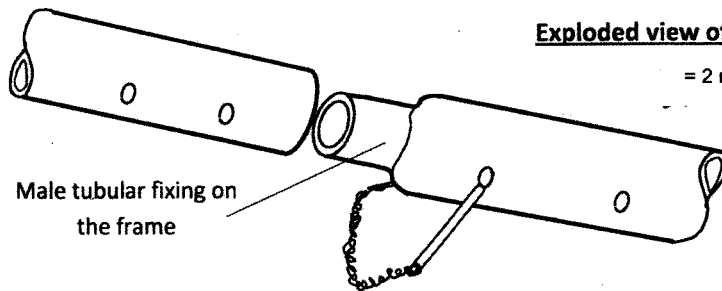
Collapsible wings

= 4 marks



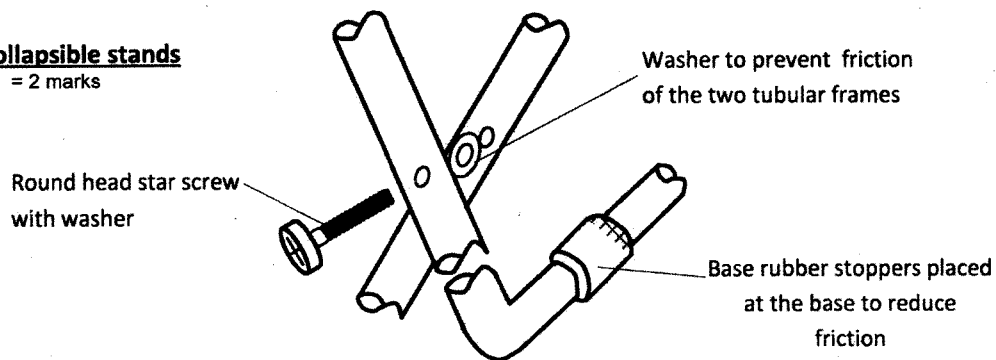
Exploded view of Collapsible side frame

= 2 marks



Collapsible stands

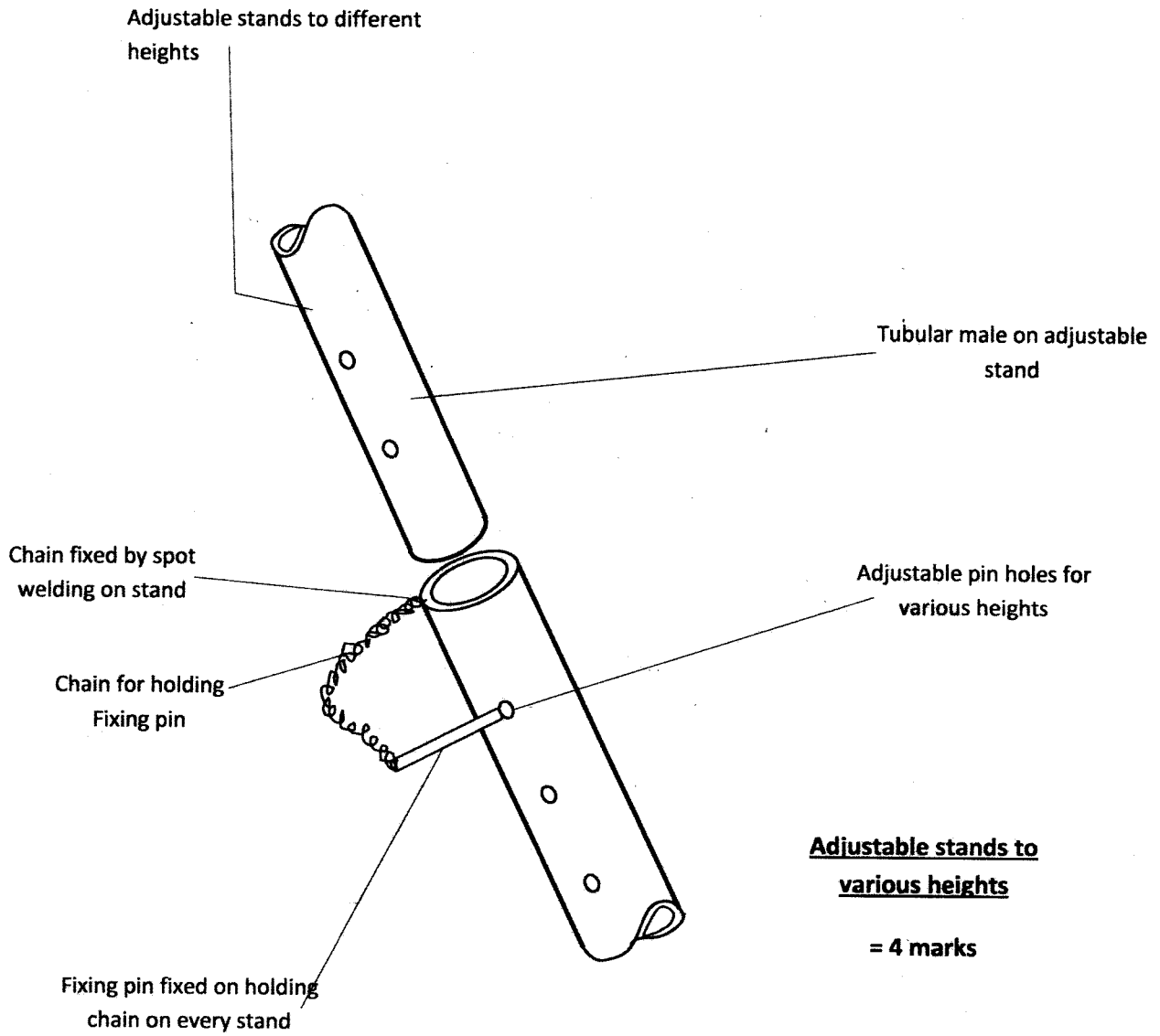
= 2 marks



sub total = 8 marks

Consideration iii

Exploded



Adjustable stands to various heights

= 4 marks

Total 8+ 4 = 12 marks

d) MATERIALS USED

- (i) • Aluminium tubular (1 mark)
- Rubber Stoppers (1 mark)

(ii) CHOICE OF MATERIAL

- Aluminium tubular: - light in weight for easy movement. ($\frac{1}{2}$ mark)
- Rubber stoppers: Anti-slip material to reduce friction on the ground when device is at work. ($\frac{1}{2}$ mark)

3 marks

(e) (i) TWO JOINING METHODS

- Riveting - (1 mark)
- Glueing - (1 mark)

(ii) WHERE APPLIED

- Riveting: - At the stands joints and collapsible wing joints. ($\frac{1}{2}$ mark)
- Glueing:- Fixing Rubber stoppers with strong adhesive to the stand base frame when device is at work. ($\frac{1}{2}$ mark)

3 marks

Total = 40 marks