basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

CIVIL TECHNOLOGY

NOVEMBER 2012

MARKS: 200

TIME: 3 hours

This question paper consists of 16 pages, 5 answer sheets and 1 formula sheet.

REQUIREMENTS:

1. Drawing instruments
2. A non-programmable pocket calculator
3. ANSWER BOOK

INSTRUCTIONS AND INFORMATION

1. This question paper consists of SIX questions.
2. Answer ALL the questions.
3. Answer each question as a whole; do NOT separate subquestions.
4. Start EACH question on a NEW page.
5. Do NOT write in the margin of the ANSWER BOOK.
6. Sketches may be used to illustrate your answers.
7. ALL calculations and written answers must be done in the ANSWER BOOK or on the attached ANSWER SHEETS.
8. Use the mark allocation as a guide to the length of your answers.
9. Drawings and sketches must be done in pencil, fully dimensioned and neatly finished off with descriptive titles and notes to conform to the SANS/SABS Code of Practice for Building Drawing Practice.
10. For the purpose of this question paper, the size of a brick should be taken as 220 mm x 110 mm x 75 mm.
11. Use your discretion where dimensions and/or details have been omitted.
12. Answer QUESTIONS 1.3, 3.4, 4.3, 6.1 and 6.2 on the attached ANSWER SHEETS using drawing instruments where necessary.
13. Write your CENTRE NUMBER and EXAMINATION NUMBER on every ANSWER SHEET and hand them in with your ANSWER BOOK, whether you have used them or not.
14. Drawings in the question paper are NOT to scale due to electronic transfer.

QUESTION 1: CONSTRUCTION PROCESSES

1.1 Choose a description from COLUMN B that matches the term in COLUMN A. Write only the letter (A–H) next to the question number (1.1.1–1.1.5) in your ANSWER BOOK, for example 1.1.7 J.

COLUMN A		COLUMN B	
1.1.1	Gang nail	A	a temporary working platform
1.1.2	King post	B	a length of material used to conceal the gap between the wall and the ceiling
1.1.3	Cornice	C	slope/angle/fall of the roof
1.1.4	Ridge capping	D	a flat plate with many spikes used in roof truss construction
1.1.5	Pitch	E	used to absorb the sound of wind
		F	vertical distance between two consecutive treads of a staircase
		G	used to cover the gap between the roof covering at the highest point of the roof
		H	longest vertical member that determines the height of the roof truss

(5)

1.2 Show, by using freehand sketches, the difference between the following types of concrete slabs: (Show the walls and slabs.)

1.2.1 Simple supported concrete slab (2)

1.2.2 Cantilever concrete slab (2)

1.3 FIGURE 1.3 on ANSWER SHEET 1.3 shows an incomplete gauged segmental arch with construction lines. The incomplete courses of surrounding brickwork are also shown.

1.3.1 Complete the gauged segmental arch by drawing the voussoirs (bricks). (3)

1.3.2 Label the key voussoir (brick). (1)

1.3.3 Draw the surrounding brickwork in stretcher bond on the right-hand side of the arch within the given courses. (1)

1.3.4 Indicate and label the rise on your drawing. (1)

1.3.5 Indicate and label the span on your drawing. (1)

1.3.6 Indicate and label the intrados on your drawing. (1)

1.3.7 Indicate and label the extrados on your drawing. (1)

1.4 FIGURE 1.4 below shows the top view of a roof layout showing the roof trusses and the outer walls of an L-shaped building. Analyse the illustration and answer the questions that follow.

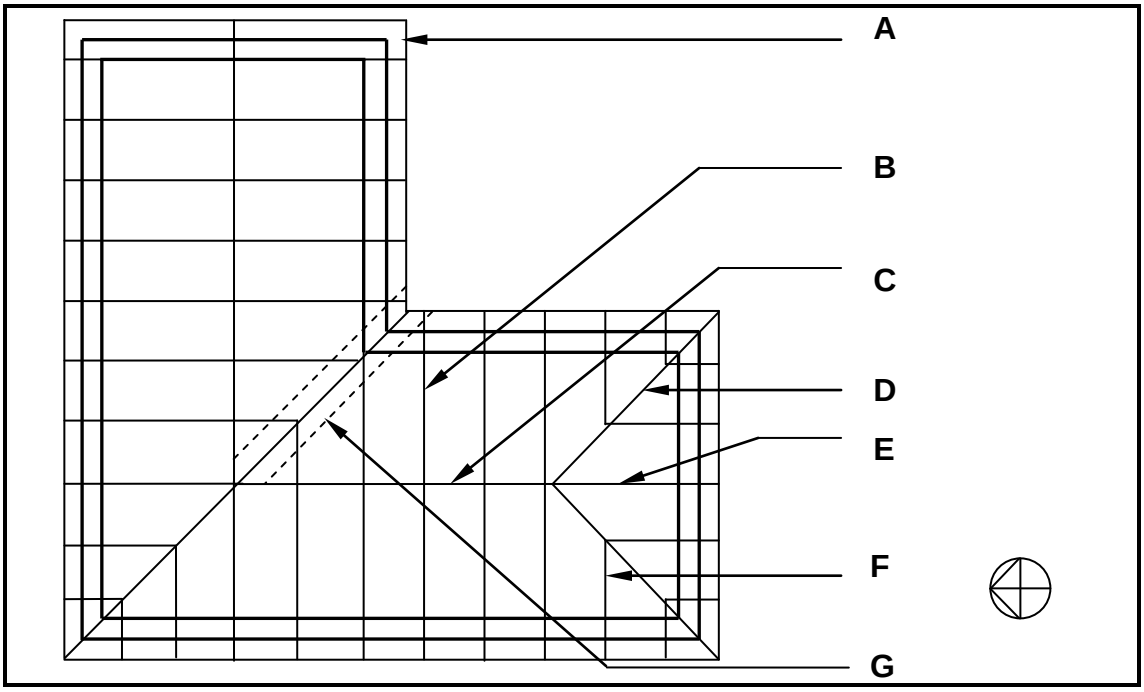

FIGURE 1.4

1.4.1 Identify component **A**. (1)

1.4.2 Name part **B**. (1)

1.4.3 Identify component **C**. (1)

1.4.4 Name the rafter at **D**. (1)

1.4.5 Name the truss at **E**. (1)

1.4.6 Name the rafter at **F**. (1)

1.4.7 Name part **G** where the TWO roof surfaces meet. (1)

1.4.8 What type of roof is used on the eastern side of the building? (1)

1.4.9 What is the maximum distance between truss centres when corrugated sheet metal or IBR sheeting is used as a roof covering? (1)

1.5 A plumber has to join two lengths of threaded galvanised water pipes.

1.5.1 What will the plumber use to ensure that the joint is watertight? (1)

1.5.2 Explain how the plumber will join the TWO pipes. (2)

[30]

Start this question on a NEW page.

QUESTION 2: ADVANCED CONSTRUCTION PROCESSES

2.1 FIGURE 2.1 below shows formwork supporting a concrete floor. Analyse the illustration and answer the questions that follow.

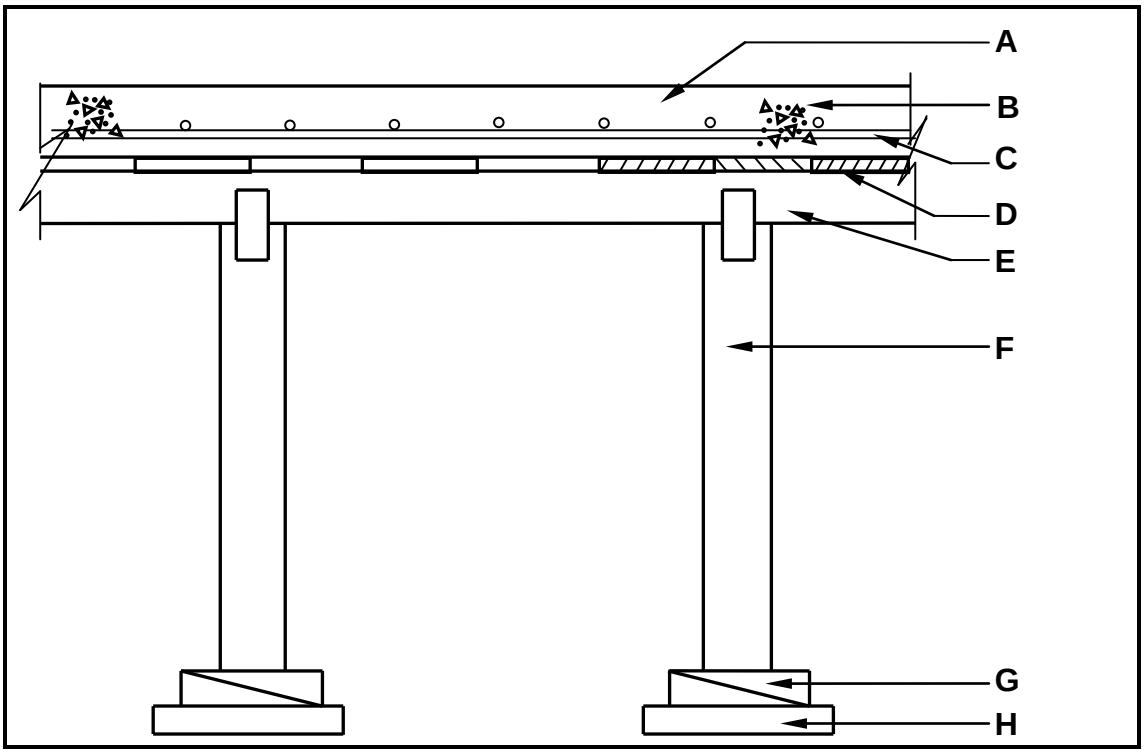

FIGURE 2.1

2.1.1 Identify components **A** to **H**. (8)

2.1.2 Explain why the reinforcement in the concrete floor is placed closer to the bottom of the floor. (2)

2.1.3 Explain the purpose of **G**. (1)

2.1.4 Explain the purpose of **H**. (1)

2.2 Reinforcement is used to strengthen concrete beams.

2.2.1 Explain the function of the main bars in a reinforced concrete beam. (2)

2.2.2 What would you use in a reinforced concrete beam to bind the main bars together and to help resist shear forces? (1)

2.3 Tabulate the differences between strip foundations and short bored piles according to the criteria in the table below. Redraw the table below in your ANSWER BOOK and tabulate your answers.

CRITERIA	STRIP FOUNDATION	SHORT BORED PILES
Preparation of foundation		
Concrete filling		

(4)

2.4 FIGURE 2.4 below shows different readings taken with a dumpy level. Use the given readings and calculate the following:

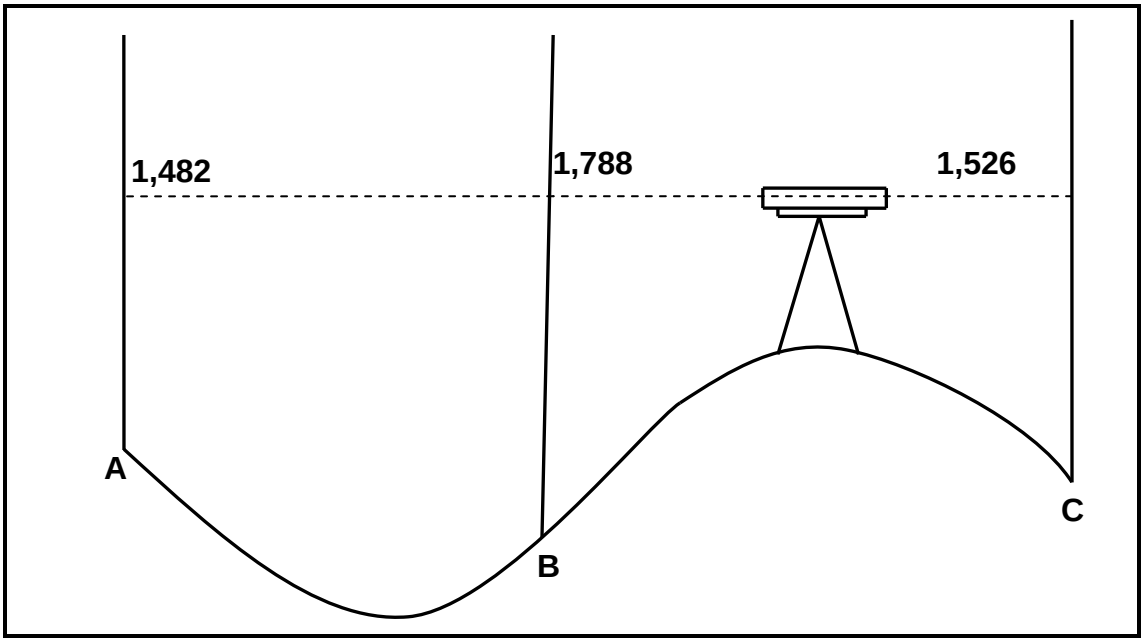

FIGURE 2.4

2.4.1 The difference in height between levelling staff **A** and levelling staff **B** (2)

2.4.2 The difference in height between levelling staff **B** and levelling staff **C** (2)

2.4.3 What is the reading at **B** called? (1)

2.4.4 Is there a rise or a fall from **B** to **C**? (1)

2.5 FIGURE 2.5 below shows an isometric view of a construction at the top of a dry-wall construction. Do NOT redraw the sketch. Use it as a hint to answer QUESTION 2.5.1.

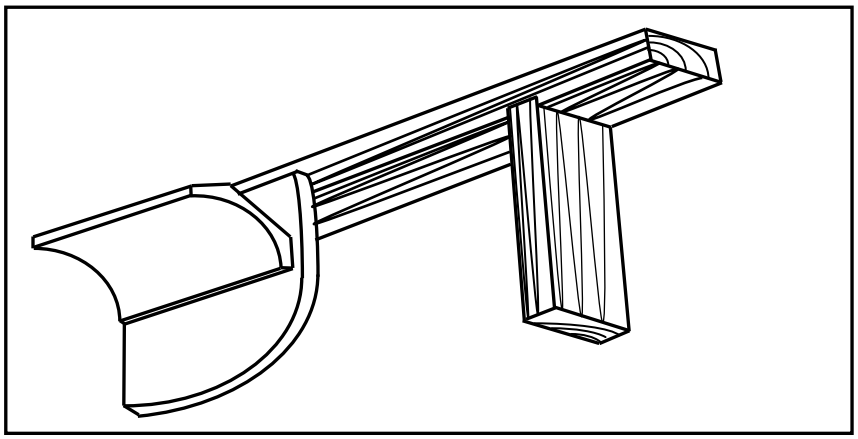

FIGURE 2.5

2.5.1 Use drawing instruments and draw a neat sketch of a vertical section through the top part of a dry-wall construction, showing how it is fixed to the ceiling and finished off.

Show the following details:

- Brandering (1)
- Ceiling board (1)
- Top rail of frame/Timber roof track (ceiling track) (1)
- Screw or nail to fix timber roof track to brandering (1)
- Timber strut (vertical) (1)
- Cladding (1)
- Cornice (1)

2.5.2 Show any THREE labels on your drawing. (3)

2.5.3 Name TWO materials that can be used for the cladding of dry walls. (2)

2.6 Describe TWO safety precautions you will take when using electric power tools. (2)

2.7 Safety signs are represented with circle, square and triangular shapes. Which shape is used to indicate general information? (1)

[40]

Start this question on a NEW page.

QUESTION 3: CIVIL SERVICES

3.1 Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (3.1.1–3.1.5) in the ANSWER BOOK, for example 3.1.6 B.

3.1.1 The purpose of a vent pipe is to …

A clear obstructions.
B allow unpleasant odours coming from a sewerage system to escape.
C trap grease.
D direct the flow of waste water. (1)

3.1.2 The main purpose of a P trap is to …

A prevent foul gases from a sewerage system from entering the building.
B ensure that sanitary fitments are fitted level.
C join all sanitary fitments to each other.
D discharge waste materials into a gully. (1)

3.1.3 The recommended gradient (fall) of a sewer pipe for household purposes is …

A 1 : 100.
B 1 : 39.
C 1 : 40.
D 1 : 125. (1)

3.1.4 The effective operation of a solar panel is dependent on …

A wind.
B the moon.
C the sun.
D clouds. (1)

3.1.5 One way of saving electricity is to …

A keep all appliances switched on at all times.
B switch the geyser off when you are away from home for a long period of time.
C switch off the water supply to the geyser when it is not in use.
D keep all lights on throughout the night. (1)

3.2 Explain THREE advantages and THREE disadvantages of a shallow well-water supply system. Redraw the table below in your ANSWER BOOK and tabulate your answers.

ADVANTAGES	DISADVANTAGES

(6)

3.3 FIGURE 3.3 below shows part of a sewerage system. Analyse the illustration and answer the questions that follow.

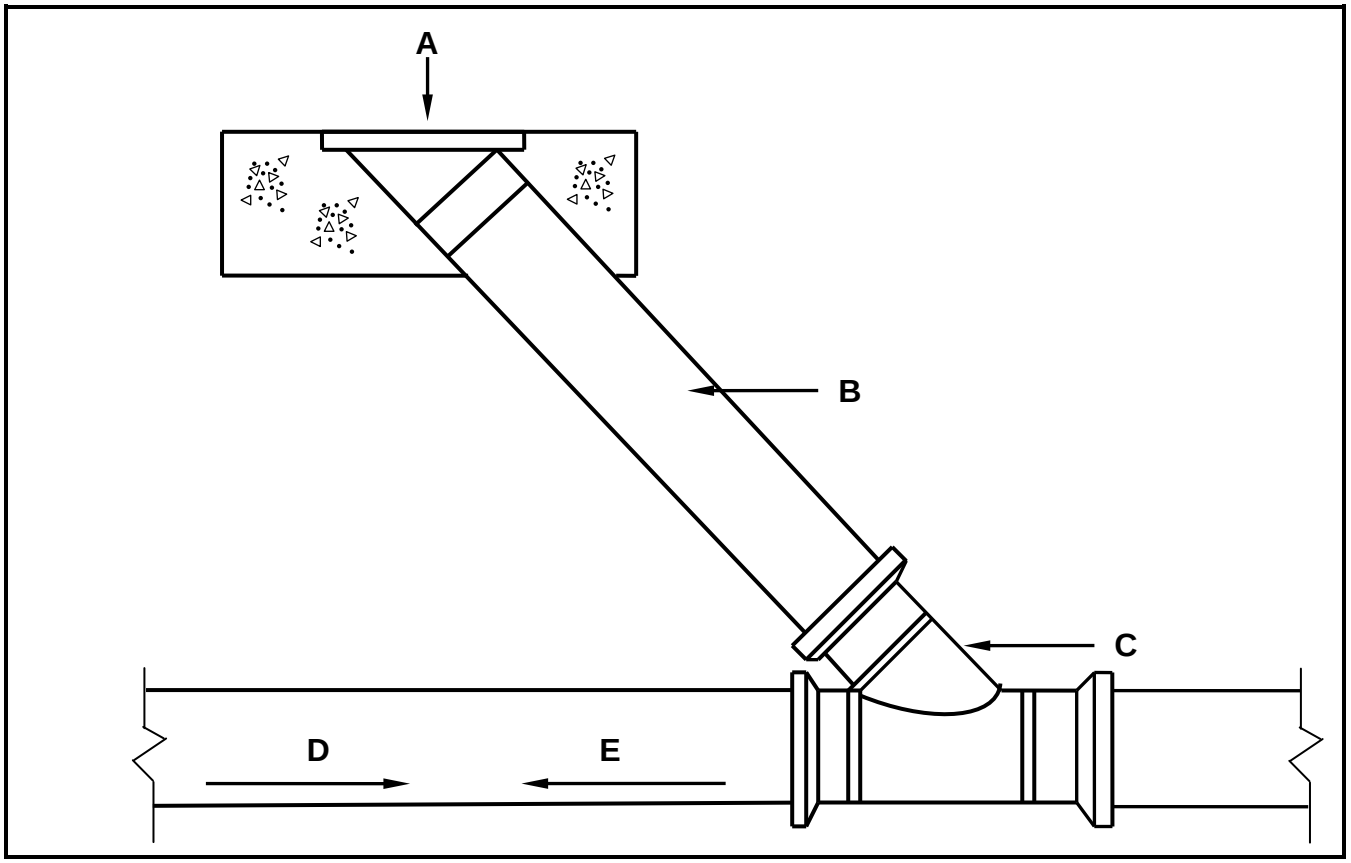

FIGURE 3.3

3.3.1 Identify components **A**, **B** and **C**. (3)

3.3.2 Determine the direction of flow of sewage (**D** or **E**). (1)

3.3.3 Explain why **B** is at an angle with the main pipe. (1)

3.3.4 Explain the purpose of component **A**. (1)

3.3.5 Discuss TWO advantages of installing component **A** in a sewerage system instead of installing a manhole. (2)

3.4 FIGURE 3.4 on ANSWER SHEET 3.4 shows a line diagram of the plan view of a house. Draw the following electrical drawing symbols on ANSWER SHEET 3.4:

3.4.1 A power socket in the garage at **A** (1)

3.4.2 A single-tube fluorescent light at **B** (1)

3.4.3 A three-lever switch at the entrance of the garage at **C** (1)

3.4.4 A wall light at the entrance of the garage at **D** (1)

3.4.5 A light in the TV room at **E** (1)

3.4.6 A single-lever switch for the light in the TV room at **F** (1)

3.4.7 A distribution board in the kitchen (1)

3.5 In the absence of a municipal waterborne sewerage system, name TWO other methods that can be used to dispose of sewage and explain the difference between the TWO methods. (4)
[30]

Start this question on a NEW page.

QUESTION 4: MATERIALS AND QUANTITIES

4.1 Indicate whether the following statements are TRUE of FALSE. Write only 'true' or 'false' next to the question number (4.1.1–4.1.6) in the ANSWER BOOK.

4.1.1 Mild steel is a metal that cannot be recycled. (1)

4.1.2 Copper is an example of a non-ferrous metal. (1)

4.1.3 Timber that has to be used outdoors must be painted or varnished to be durable. (1)

4.1.4 Rolled glass consists of a polymer sheet between two layers of glass. (1)

4.1.5 Safety glass must be used for all glazed sliding doors. (1)

4.1.6 Bolts and nuts can be used to join members of a steel roof truss. (1)

4.2 You are given TWO options for preserving timber. One is submersion and the other one the full-cell process.

Give ONE advantage of:

4.2.1 Submersion (1)

4.2.2 The full-cell process (1)

4.3 FIGURE 4.3 shows the front elevation and vertical section of a part of a wall (superstructure only).

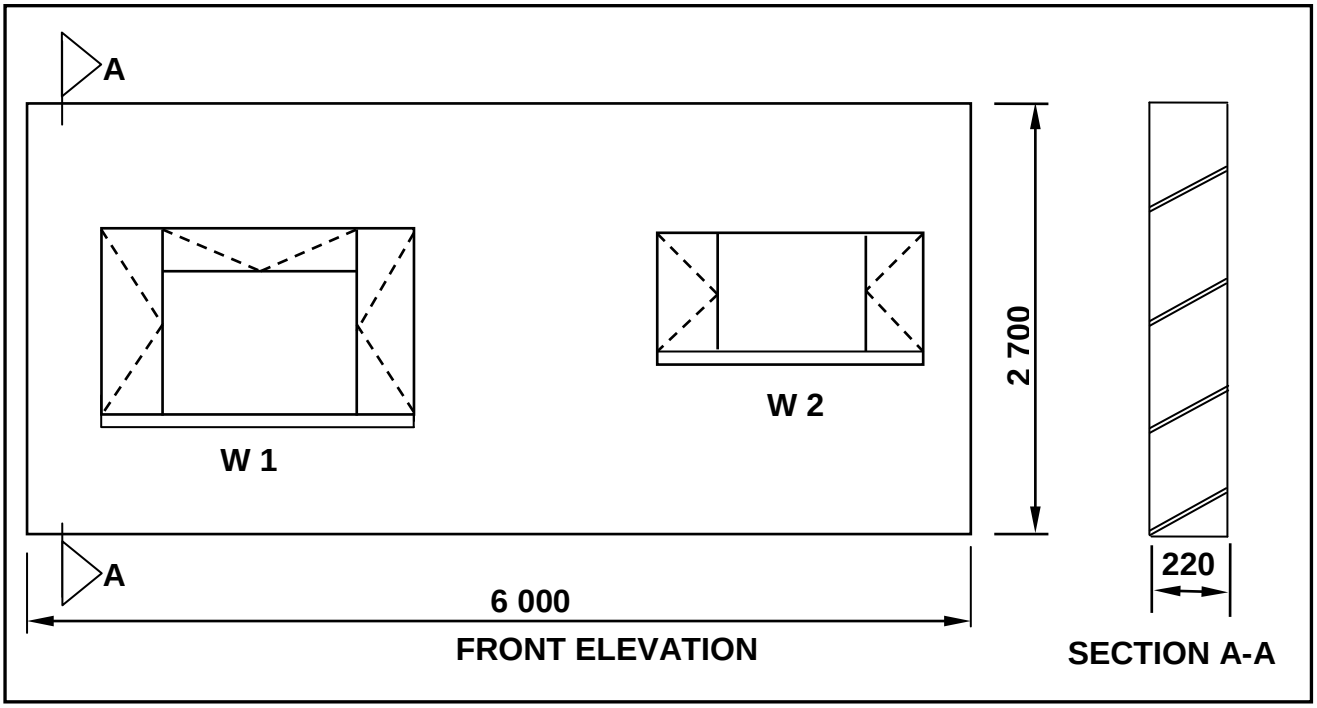

FIGURE 4.3

Specifications:

- 110 bricks were used to build one square metre of a 220 mm thick wall.
- Window 1 (W1) is 1 200 mm wide and 1 500 mm high.
- Window 2 (W2) is 1 200 mm wide and 600 mm high.

Use the specifications above and calculate the following on ANSWER SHEET 4.3:

4.3.1 The total area of the wall, including windows (before deductions) (4)

4.3.2 The area of window 1 (3)

4.3.3 The area of window 2 (3)

4.3.4 The total wall area, excluding windows (1)

4.3.5 The total number of bricks required to build the wall, including 5% wastage and breakages (6)

4.4 Complete the following sentences by using the words in the list below. Write only the word next to the question number (4.4.1–4.4.5) in the ANSWER BOOK.

breaking; forces; angle iron; copper; shock; galvanizing; corrosive

4.4.1 The strength of a material refers to its ability to resist forces being applied to it without …, bending, splintering or changing shape. (1)

4.4.2 … is a profile of steel that can be used for steel roof construction. (1)

4.4.3 An example of a material that will not corrode is … (1)

4.4.4 One method of preventing metal from corroding is called … (1)

4.4.5 The durability of a metal can refer to the metal's resistance to … factors such as water, air, salts, and acids. (1)

[30]

Start this question on a NEW page.

QUESTION 5: APPLIED MECHANICS

5.1 FIGURE 5.1 below shows the space and shear-force diagrams of a beam with a span of 8 m with two point loads and a uniformly distributed load. Analyse the diagrams and answer the following questions.

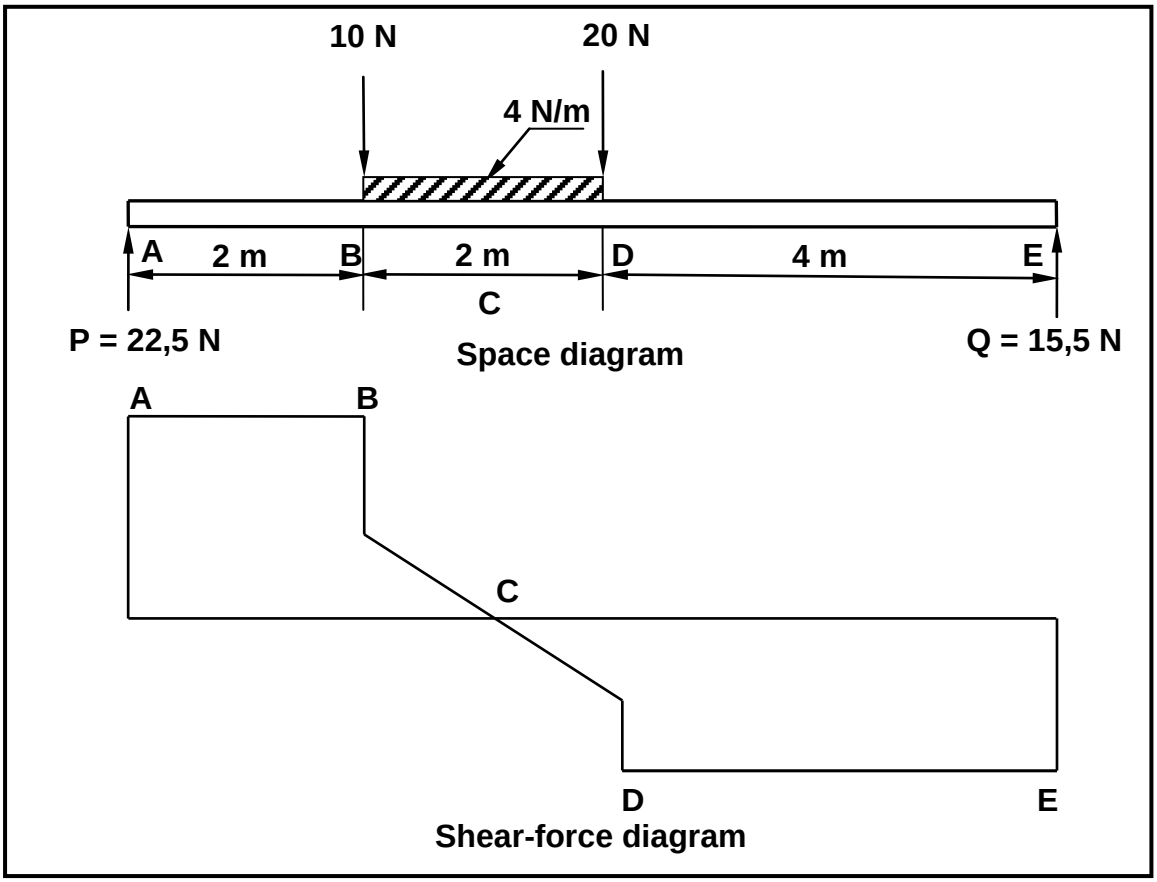

FIGURE 5.1

5.1.1 Convert the uniformly distributed load to a point load and write down the value of the converted point load. (1)

5.1.2 Deduce the value of the point load at **D** from the space diagram. (1)

5.1.3 Deduce the value of the uniformly distributed load at **D** from the space diagram. (1)

5.1.4 Determine the distance of the converted uniformly distributed load that is now a point load, to **P**. (2)

5.1.5 Prove by means of calculation that the beam is in equilibrium. (2)

5.1.6 Recommend a suitable scale for the shear-force diagram so that it will fit on a sheet of A4 paper with the space diagram. (1)

5.1.7 Deduce from the space diagram the value of the shear force at **A** (SFa). (1)

5.1.8 Prove by means of calculation that the value of the shear force at **B** (SFb) is equal to 12,5 N. (2)

5.1.9 Prove by means of calculation that the value of the shear force at **D** (SFd) is -15,5 N. (2)

5.1.10 Prove by means of calculation that the value of the shear force at **E** (SFe) is 0 N. (2)

5.1.11 Is there an error in the shear force diagram regarding the magnitude of the forces? Write only YES or NO. (1)

5.2 FIGURE 5.2 below shows a lamina.

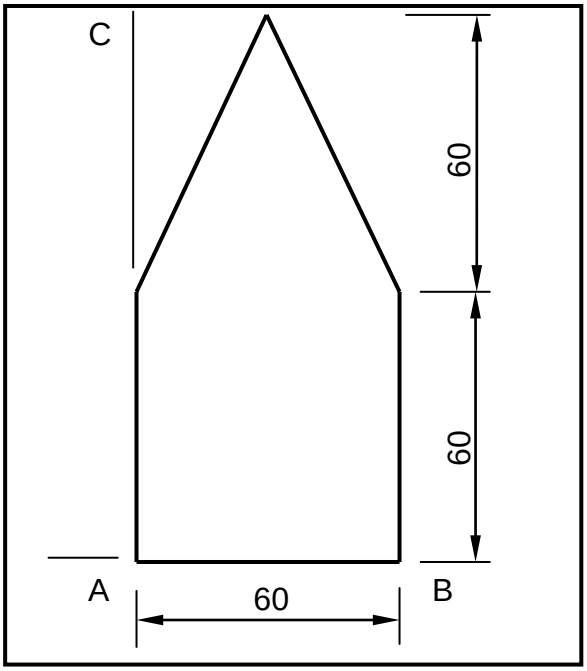

FIGURE 5.2

5.2.1 Calculate the position of the centroid of the lamina from **A**–**B**. (12)

5.2.2 Deduce from FIGURE 5.2 the position of the centroid from **A**–**C**.

Round off your answer to TWO decimal places. (2)
[30]

QUESTION 6: GRAPHIC COMMUNICATION

6.1 Use ANSWER SHEET 6.1 and draw to scale 1 : 20 the front elevation of a South African roof truss (Howe truss) of which all members are joined by using gang nails.

Use the following specifications:

- Pitch of truss: 30º
- Length of the tie beam: 4 metres (4 000 mm)
- All timber for roof truss: 114 mm x 38 mm
- Eaves overhang: 300 mm (13)

Show any TWO labels on your drawing. (2)

6.2 FIGURE 6.2 below shows a line diagram of a floor plan of a Civil Technology workshop.

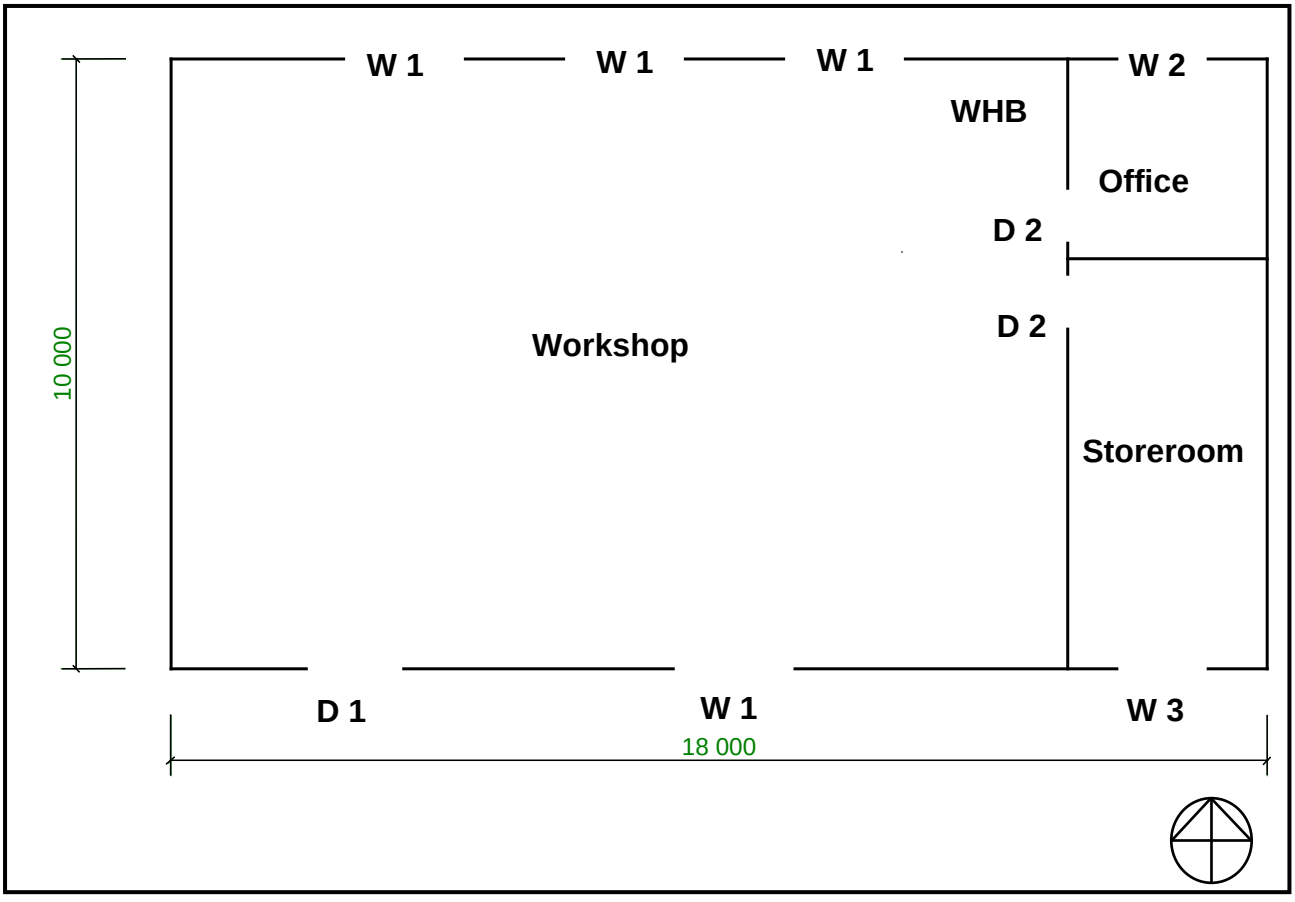

FIGURE 6.2

6.2.1 Draw the floor plan of the workshop to scale 1 : 100 on ANSWER SHEET 6.2.

6.2.2 Draw the windows and doors on the floor plan in the spaces as indicated on the line diagram.

Specifications:

Measurements of workshop:

- Use measurements as shown on the line diagram.
- Inside measurements of office are 3 000 mm x 3 000 mm.
- External walls are 220 mm thick.
- Internal walls are 110 mm thick.

	WIDTH	**HEIGHT**
Window 1 (W1)	2 000 mm	1 200 mm
Window 2 (W2)	1 500 mm	900 mm
Window 3 (W3)	1 500 mm	600 mm
Door 1 (D1)	1 600 mm	2 000 mm
Door 2 (D2)	900 mm	2 000 mm

6.2.3 Draw the drawing symbol for a hand basin on the floor plan in the space as indicated on the line diagram.

6.2.4 Design and draw the top view of a hipped roof in dashed lines on the floor plan on ANSWER SHEET 6.2. The eaves overhang is 450 mm.

6.2.5 Show TWO dimensions on the eastern side of the workshop.

6.2.6 Insert the title and scale. (25)
[40]

TOTAL: 200

ANSWER SHEET 1.3

CENTRE NUMBER:								

EXAMINATION NUMBER:													

QUESTION 1.3

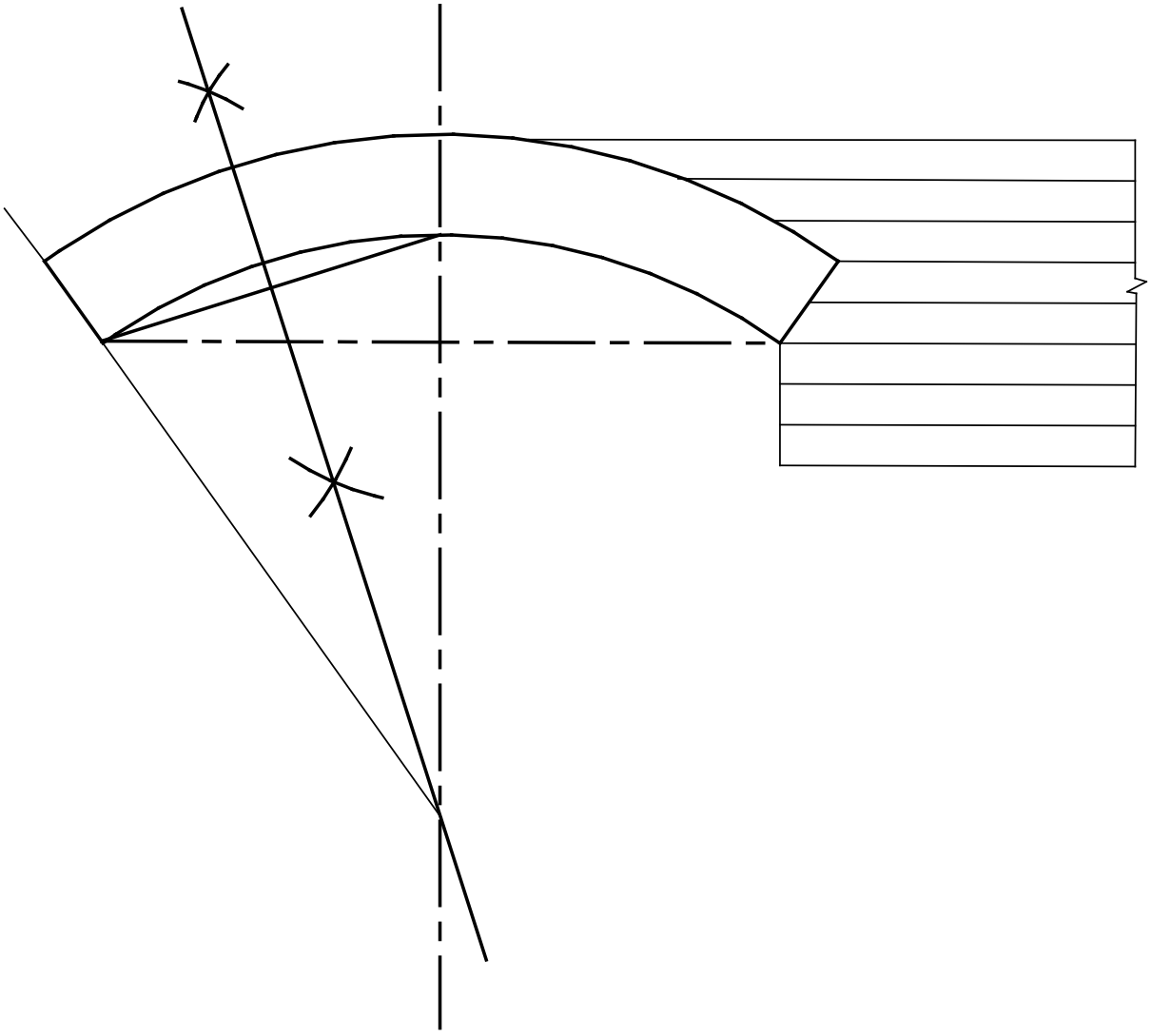

FIGURE 1.3

ASSESSMENT CRITERIA	MARKS	LEARNER'S MARK
Voussoirs	3	
Key voussoir	1	
Surrounding brickwork	1	
Rise (indicate and label)	1	
Span (indicate and label)	1	
Intrados (indicate and label)	1	
Extrados (indicate and label)	1	
Total	**9**	

(9)

ANSWER SHEET 3.4

CENTRE NUMBER:								

EXAMINATION NUMBER:													

QUESTION 3.4

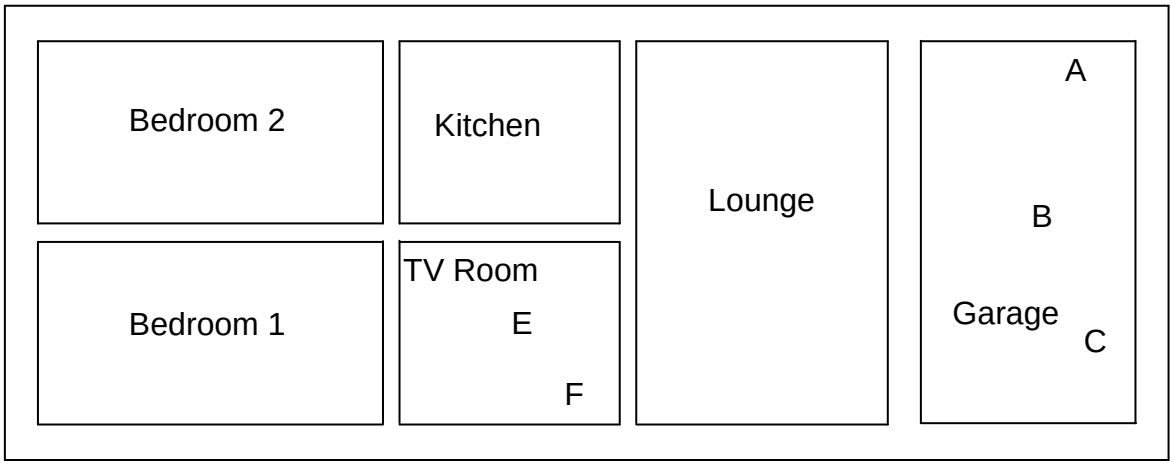

FIGURE 3.4

(7)

ANSWER SHEET 4.3

CENTRE NUMBER:								

EXAMINATION NUMBER:													

QUESTION 4.3

A	B	C	D
			Area of wall before deductions
			Area of window 1
			Area of window 2
			Total area of wall excluding windows
			Number of bricks
			5% wastage and breakage
			Total number of bricks

(17)

ANSWER SHEET 6.1

CENTRE NUMBER:								

EXAMINATION NUMBER:													

QUESTION 6.1

ASSESSMENT CRITERIA	MARKS	LEARNER'S MARK
Rafter	2	
King post	1	
Strut	2	
Queen post	2	
Tie beam	1	
Neatness	2	
Application of scale	3	
Any TWO labels	2	
Total	**15**	

(15)

ANSWER SHEET 6.2

CENTRE NUMBER:								

EXAMINATION NUMBER:													

QUESTION 6.2

ASSESSMENT CRITERIA	MARKS	LEARNER'S MARK
External walls	4	
Internal walls	2	
Windows	6	
Doors	3	
Roofline	4	
WHB	1	
Labelling	2	
Any TWO dimensions	2	
Neatness	1	
Total	**25**	

(25)

FORMULA SHEET

IMPORTANT ABBREVIATIONS

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTIONS	SYMBOL	DESCRIPTION
G	Centre of gravity	h	Height	d	Diameter
C	Centroid	b	Breadth/Width	r	Radius
L	Length	s	Side	A	Area
π	Pi = $\frac{22}{7}$ = 3,142	Ø	Diameter	V	Volume

FORMULAE

AREA OF	FORMULA (in words)	FORMULA (in symbols)	FORMULA FOR THE POSITION OF CENTROIDS	
			X-axis	Y-axis
Square	side x side	s x s	$\frac{s}{2}$	$\frac{s}{2}$
Rectangle	length x breadth	ℓ x b	$\frac{\ell}{2}$	$\frac{b}{2}$
Right-angled triangle	½ x base x height	½b x h	$\frac{b}{3}$	$\frac{h}{3}$
Equilateral triangle/ Pyramid	½ x base x height	½b x h	$\frac{b}{2}$	$\frac{h}{3}$
Circle	π x radius x radius	πr^2	Centroid is in the centre	
Circle	π x diameter x diameter divided by 4	$\frac{\pi d^2}{4}$		
Semi-circle	π x radius x radius divided by 2	$\frac{\pi r^2}{2}$	Centroid is 0,424r on the centre line	

$$\text{Position of centroid} = \frac{(A1 \times d) \pm (A2 \times d)}{\text{Total area}}$$

OR

$$X = \frac{\sum Ay}{\sum A}$$