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Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

## **NATIONAL SENIOR CERTIFICATE**

**GRADE 12**

**CIVIL TECHNOLOGY**

**FEBRUARY/MARCH 2012**

**MARKS: 200**

**TIME: 3 hours**

**This question paper consists of 17 pages, 5 answer sheets and a formulae 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. Sketches may be used to illustrate your answers.
6. ALL calculations and written answers must be done in the ANSWER BOOK or on the attached ANSWER SHEETS.
7. Use the mark allocation as a guide to the length of your answers.
8. 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.
9. For the purpose of this question paper, the size of a brick should be taken as 220 mm x 110 mm x 75 mm.
10. Use your discretion where dimensions and/or details have been omitted.
11. Non-programmable pocket calculators may be used.
12. Answer QUESTIONS 2.8, 4.1, 5.2, 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 a term in COLUMN A. Write only the letter (A–L) next to the question number (1.1.1–1.1.10) in your ANSWER BOOK, for example 1.1.11 M.

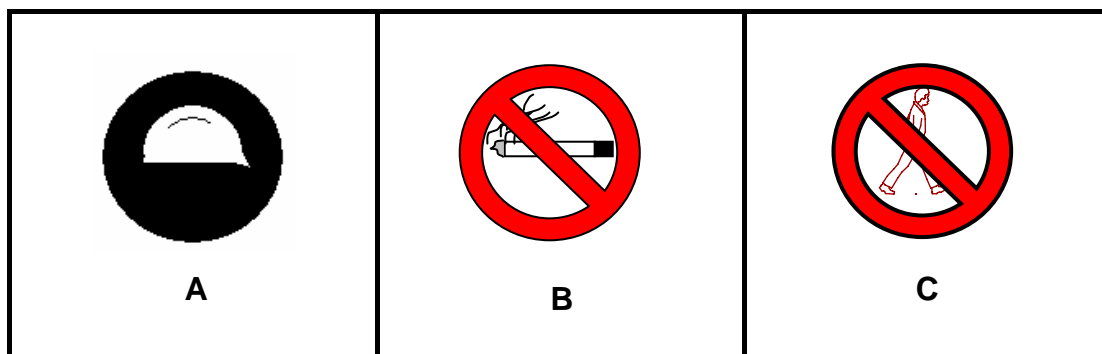
<b>COLUMN A TERMINOLOGY</b>	<b>COLUMN B DESCRIPTION</b>
1.1.1 Tripod	A environmentally friendly building built of environmentally friendly materials and systems
1.1.2 Gradient	
1.1.3 Excavation	B type of metal that will not rust
1.1.4 Green building	C used to fix roof sheets to the roof
1.1.5 Pollution	D roof sheeting is made of this material
1.1.6 Aluminium	E used as ceiling material
1.1.7 Perspex	F a square piece of timber on to which ceiling boards are fixed
1.1.8 Gypsum board	G temporary support for fresh concrete when it is being cast
1.1.9 Cement fibre	
1.1.10 Formwork	H angle or slope of fall for a sewerage system
	I contamination of water, air or soil
	J stand on which the dumpy level is mounted
	K removal of soil to form a trench
	L can be used in place of glass

(10 x 1) (10)

- 1.2 It is a very hot day and one of the workers on site has fainted. Analyse the situation and explain the treatment you will administer to the person. (4)
- 1.3 Roof trusses play an important role to provide protection to a building.
- 1.3.1 Show, by means of line diagrams, the difference between a South African (Howe) and a fink (W) roof truss. (4)
- 1.3.2 Label ONE of the two line diagrams with any TWO labels. (2)

1.4 What determines the spacing of roof trusses in a building? (1)

1.5 The safety signs (symbols) below are of safety precautions.



1.5.1 Identify the safety signs labelled **A**, **B** and **C** above. (3)

1.5.2 Explain where they will be applicable on a construction site. (3)

1.6 FIGURE 1.6 is a sketch of a steel column fixed onto a concrete base. Analyse the sketch and explain the process of securing the column to the concrete base after the concrete has just been cast.

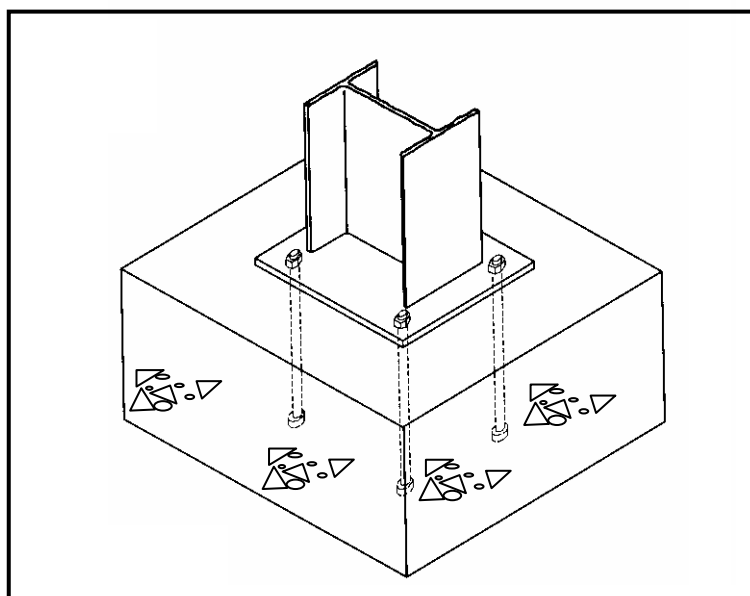
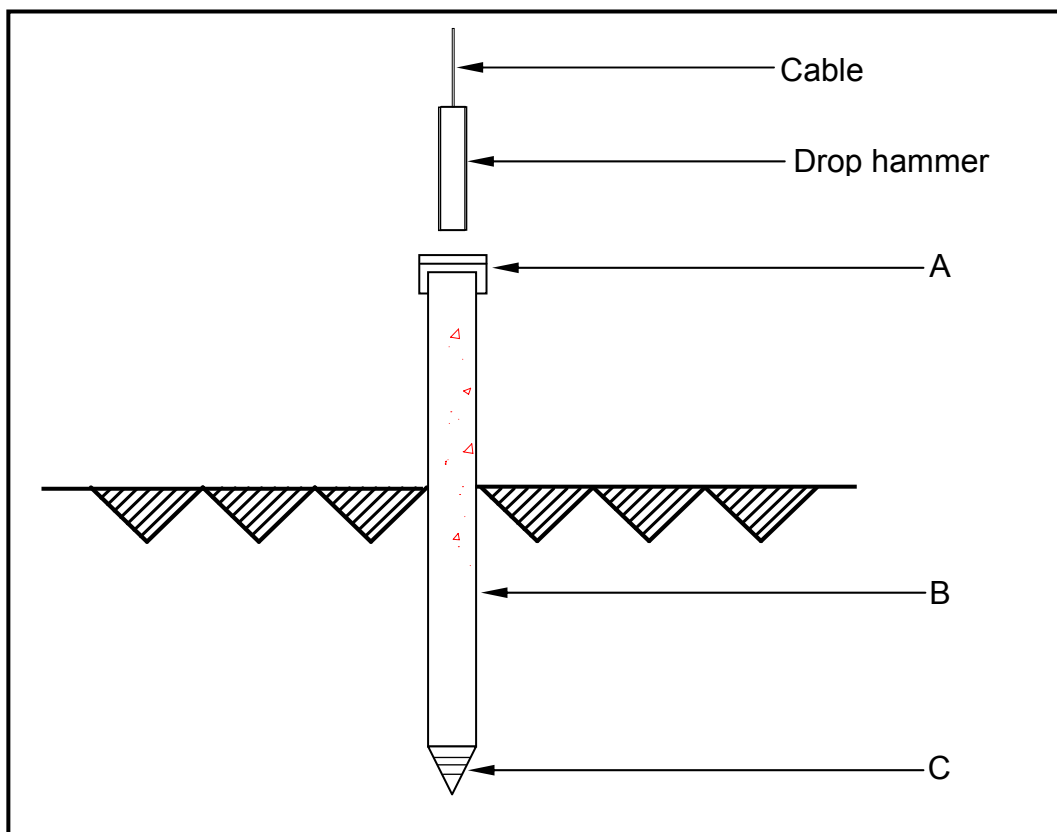


FIGURE 1.6

(3)  
[30]

**QUESTION 2: ADVANCED CONSTRUCTION PROCESSES**

- 2.1 FIGURE 2.1 shows a pile being percussion-driven into the ground using a drop hammer.



**FIGURE 2.1**

- 2.1.1 Write down the letters A–C in your ANSWER BOOK and next to the letters, the correct name of the part. (3)
- 2.1.2 In what type of soil structure should this pile be used? (1)
- 2.2 Name TWO materials that can be cut with an angle grinder. (2)
- 2.3 Explain the abbreviations *BM* and *BS* applicable when taking measurements with the dumpy level. (2)

- 2.4 Compare cast in situ reinforced concrete floor slabs with block and beam concrete floor slabs using ANY THREE of the criteria in the table below. Redraw the table below in your ANSWER BOOK and tabulate your answers.

CRITERIA	IN-SITU FLOOR SLAB	BLOCK AND BEAM
Cost		
Duration of installation		
Formwork		
Insulation		
Labour		
Weight		

(6)

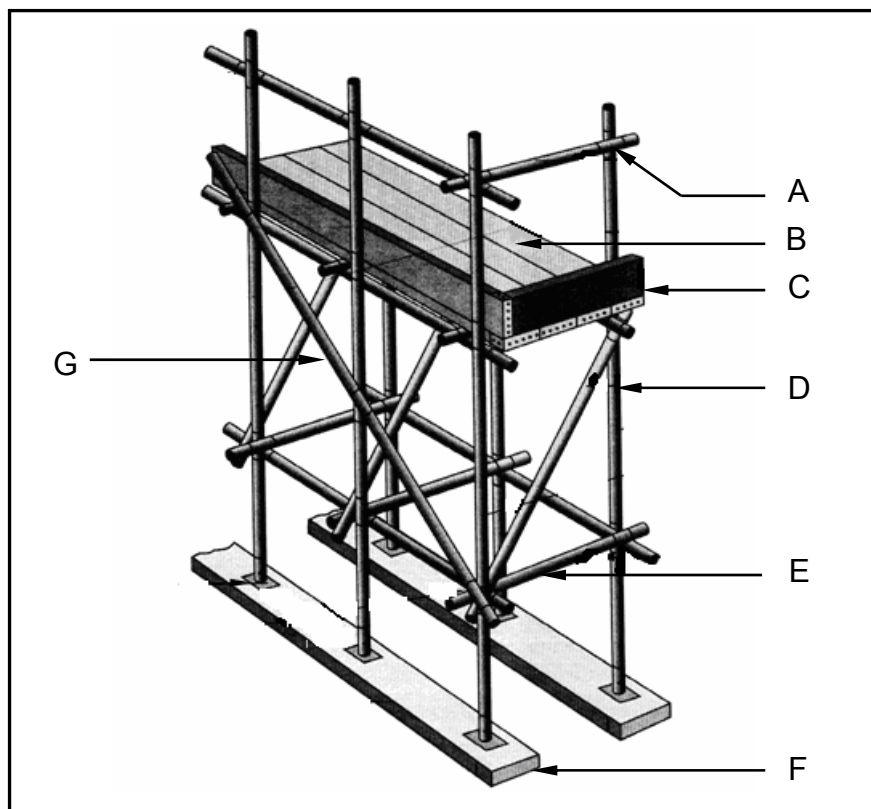
- 2.5 Explain why steel is used in concrete. (2)

- 2.6 Reinforcement has to be kept away from formwork to maintain the minimum concrete cover.

- 2.6.1 What is used to maintain the distance between the reinforcement and formwork? (2)

- 2.6.2 What is the purpose of having minimum concrete coverage? (1)

2.7 FIGURE 2.7 shows a scaffold with a working platform.



**FIGURE 2.7**

- |       |  |     |
|-------|--|-----|
| 2.7.1 | Identify the type of scaffold.   | (1) |
| 2.7.2 | Explain the purpose of part <b>F</b> ?   | (2) |
| 2.7.3 | Describe TWO safety precautions that you will take when working on a scaffold. | (2) |
| 2.7.4 | Explain the safety purpose of <b>A</b> .                                       | (2) |
| 2.7.5 | What is the purpose of <b>G</b> ?  | (2) |
| 2.7.6 | What is the purpose of <b>C</b> in terms of safety?                            | (2) |

2.8 Use ANSWER SHEET 2.8 and draw to scale 1 : 10 the vertical section through an in situ reinforced concrete floor slab of a double-storey building. The floor slab rests halfway into the 220 mm thick brick walls on either side. The distance between the walls is 2 000 mm.

Show the following in your drawing:

- Part of the 220 mm brick wall above and below the floor slab on either side
- 10 mm diameter reinforcing mesh/rods
- Minimum concrete cover
- 150 mm thick concrete floor slab
- Measurements for thickness of walls and floor and penetration into the walls
- Label your drawing.

(10)  
[40]



**QUESTION 3: CIVIL SERVICES**

3.1 Explain FOUR ways in which you will maintain a gas geyser (water heater). (4)

3.2 A conservancy tank can be used in the absence of a waterborne sewerage system and where a septic tank cannot be used.

3.2.1 Make a neat, labelled sketch of the sectional view of a conservancy tank, excluding the valve chamber. (7)

3.2.2 Show the following labels on your drawing:

- Manhole cover
  - Concrete cover slab
  - Inflow
  - Waterproof cement plaster
  - Reinforced concrete floor slab
  - Outflow
  - Fall/Slope/Gradient
- (7)

3.3 Complete the following sentences to make them TRUE. Write only the missing word next to the question number (3.3.1–3.3.4) in your ANSWER BOOK.

3.3.1 Solar energy is totally dependent on the ... (1)

3.3.2 By using energy-saving globes one can ... one's electricity bill. (1)

3.3.3 ... energy is generated by water. (1)

3.3.4 The ... of nuclear energy are radio-active and need to be stored. (1)

3.4 Distinguish between the advantages and the disadvantages of solar energy. Redraw the table below in your ANSWER BOOK and tabulate your answer.

ADVANTAGES	DISADVANTAGES

(4)

3.5 FIGURE 3.5 below shows two methods of joining copper pipes.

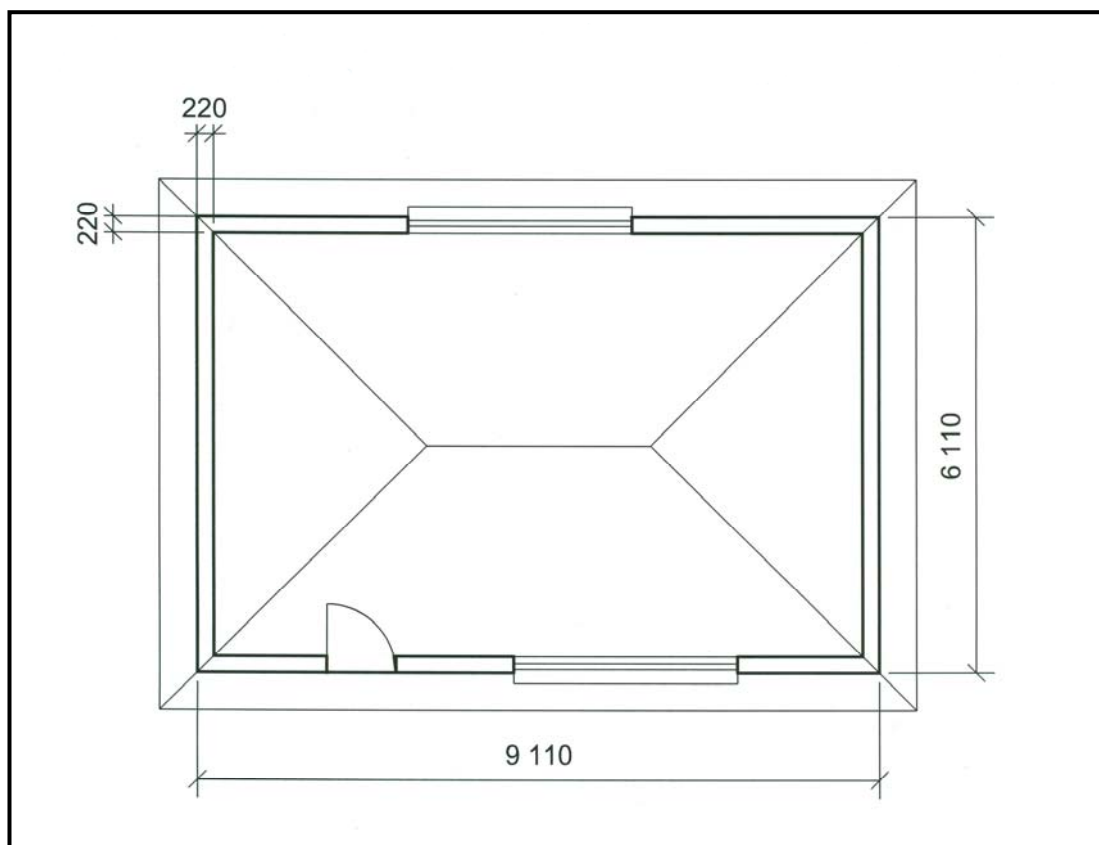


**FIGURE 3.5**

- 3.5.1 Identify the types of fittings labelled **A** and **B**. (2)
- 3.5.2 Explain ONE advantage of EACH type of fitting. (2)
- [30]**

**QUESTION 4: MATERIALS AND QUANTITIES**

- 4.1 FIGURE 4.1 shows the floor plan of a building with a hipped roof. Use ANSWER SHEET 4.1 to answer this question.

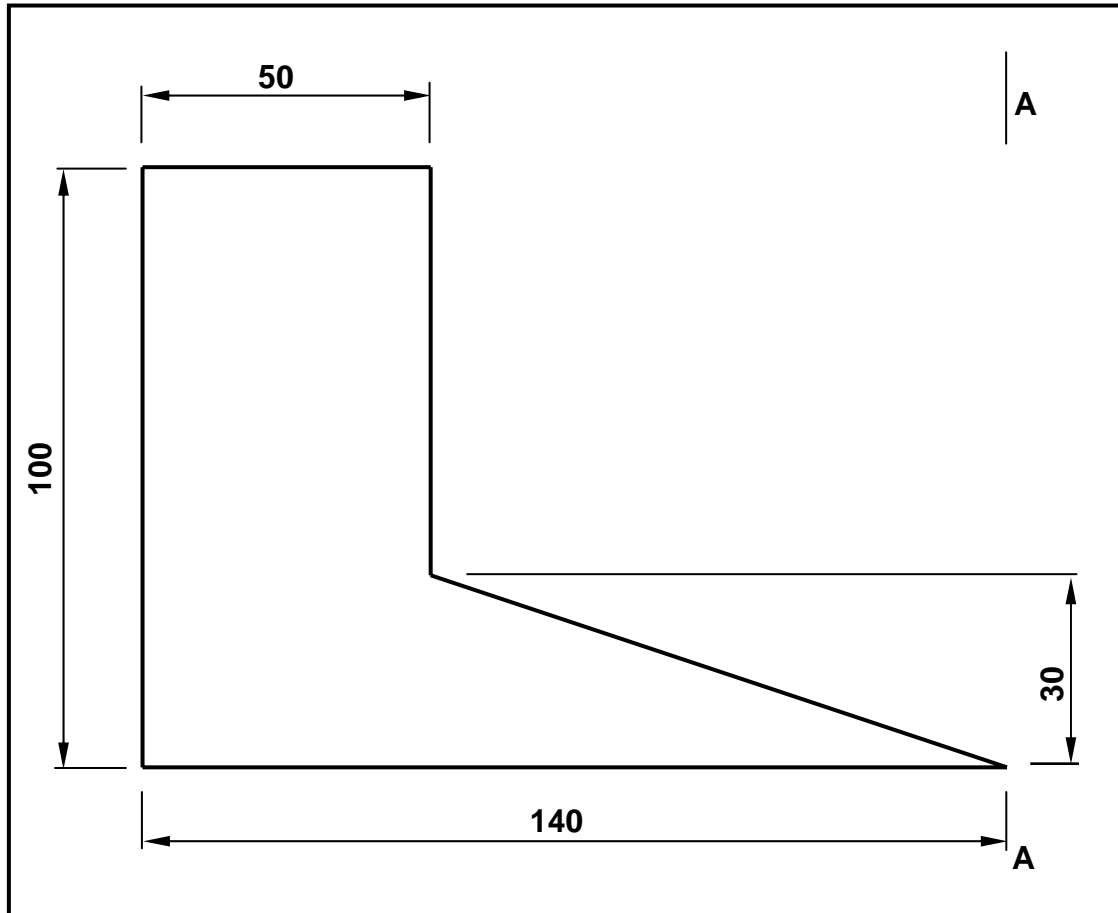
**FIGURE 4.1**

- 4.1.1 Calculate the total area of the building (exterior measurement). Round off your answer to TWO decimals. (2)
- 4.1.2 Calculate the total length of the skirting required for the building. The door frame is flush to the inside wall of the building and the door opening is 900 mm (the skirting will be joined by means of a mitre joint in the corners). (5)
- 4.1.3 Calculate the volume of concrete for the 75 mm thick floor slab, if the floor slab lies flush with the inside of the walls. Round off your answer to TWO decimals. (2)
- 4.1.4 Calculate the cost of the floor slab if the cost of concrete is R575,00 per m<sup>3</sup>. (2)

- 4.2 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (4.2.1–4.2.7) in the ANSWER BOOK.
- 4.2.1 Gypsum board is the most suitable material to seal off eaves. (1)
- 4.2.2 Cement must be stored under cover. (1)
- 4.2.3 The slump test is used to test the strength of cement. (1)
- 4.2.4 By-products are natural materials. (1)
- 4.2.5 The size of a wall plate for a roof is 100 mm x 20 mm. (1)
- 4.2.6 Non-ferrous metal is used for window frames in coastal areas because it does not rust. (1)
- 4.2.7 Plastic is the most economic material to use as roof underlay. (1)
- 4.3 You are required to make a bathroom cabinet. There are many types of materials that can be used.
- 4.3.1 Name any TWO board products that can be used to make the cabinet. (2)
- 4.3.2 Compare ONE characteristic of board products with solid timber. (2)
- 4.3.3 If the cabinet is manufactured of solid timber, explain the process of finishing and varnishing the cabinet. (4)
- 4.4 You are expected to do a cube test.
- 4.4.1 Describe TWO aspects to prepare the cube. (2)
- 4.4.2 Describe the process of putting the concrete in the cube. (2)
- [30]**

**QUESTION 5: APPLIED MECHANICS**

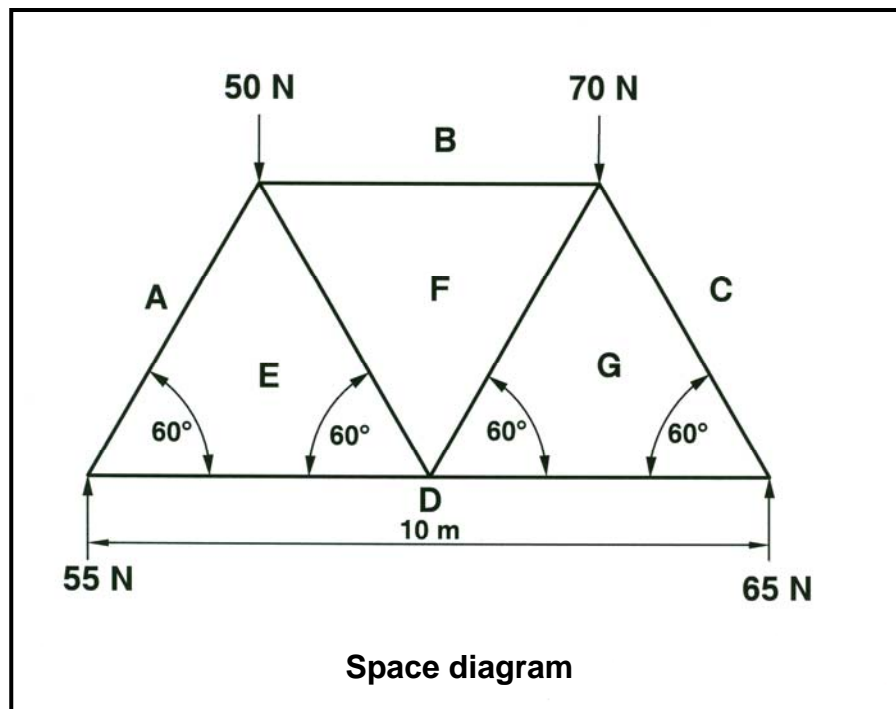
5.1 FIGURE 5.1 below shows a lamina. ALL measurements are in millimetres.



**FIGURE 5.1**

- 5.1.1 Write down the distance of the centroid of the rectangle from A-A. (1)
- 5.1.2 Write down the distance of the centroid of the right-angle triangle from A-A. (1)
- 5.1.3 Analyse the lamina and calculate the position of the centroid from A-A. Round off your answer to TWO decimals. (8)

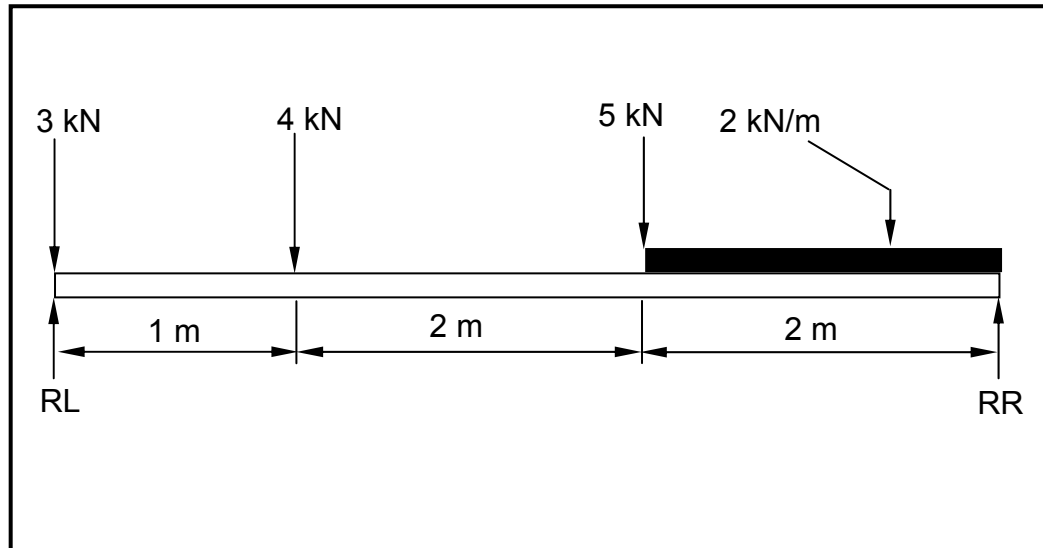
5.2 FIGURE 5.2 shows the space diagram of a framed roof truss.



**FIGURE 5.2**

- 5.2.1 Analyse FIGURE 5.2 and develop and draw the vector (force) diagram of this frame on ANSWER SHEET 5.2. Use scale 1 mm = 1 N. (9)
- 5.2.2 Show the nature of forces BF and DG on the space diagram on ANSWER SHEET 5.2, by means of arrows. (1)
- 5.2.3 Use the information from the space diagram and the vector diagram and complete the table on the ANSWER SHEET 5.2. (4)

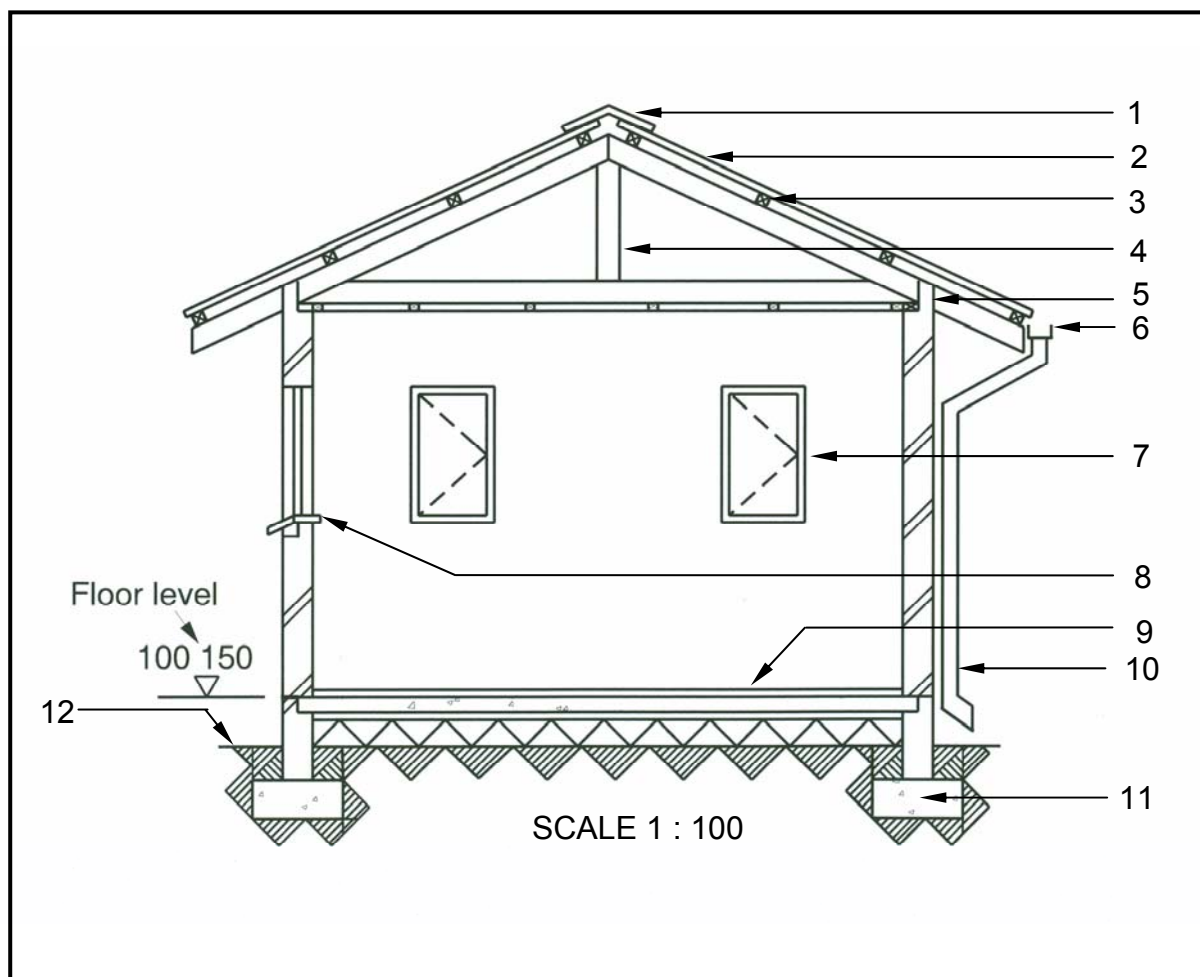
- 5.3 FIGURE 5.3 shows a beam of 5 metres resting on two supports. The beam carries a uniformly distributed load of 2 kN/m across 2 metres on the right end and three point loads. Calculate the magnitude of the reaction force at RR by taking moments about RL.

**FIGURE 5.3**

(6)  
[30]

**QUESTION 6: GRAPHIC COMMUNICATION**

- 6.1 FIGURE 6.1 illustrates the sectional view of a proposed dwelling built on a level site. Analyse the drawing and complete the table on ANSWER SHEET 6.1.

**FIGURE 6.1****(15)**



6.2 FIGURE 6.2 shows the floor plan of a proposed building.

6.2.1 Develop and draw to scale 1 : 100, on ANSWER SHEET 6.2, the SOUTH ELEVATION of the building. Use the specifications given below as well as the window schedule shown in FIGURE 6.3.

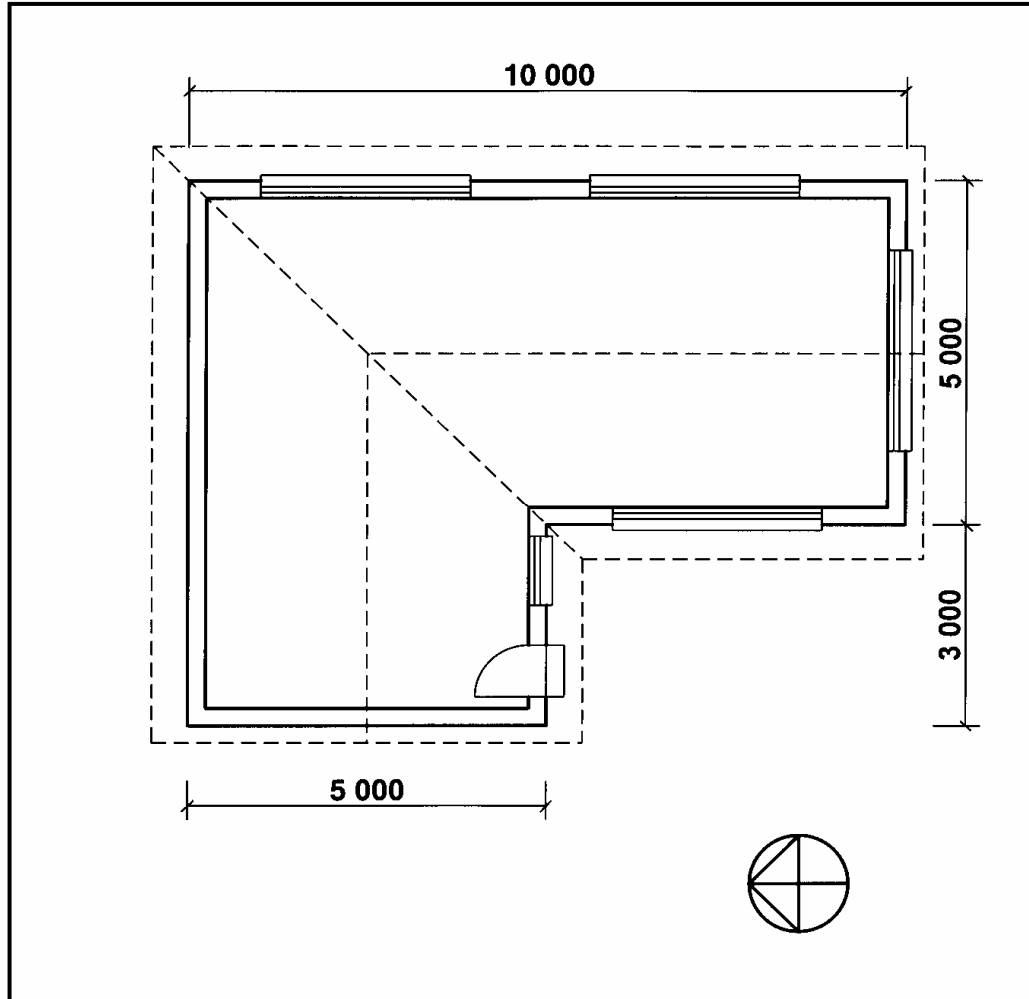


FIGURE 6.2

## Specifications:

- The door is 2 000 mm high and 900 mm wide.
- The roof is covered with galvanised sheeting and is finished with 220 mm wide fascia boards and barge boards.
- Rainwater downpipes are 75 mm in diameter and 100 mm square gutters are used.
- Height between the finished floor level of floor slab and underside of wall plate is 2 700 mm.
- The height between the natural ground level and the finished floor level of the floor slab is 300 mm.
- The eaves overhang is 500 mm.
- The gable end overhang is 200 mm.
- The door step is 150 mm high.
- The building has a gable roof with a pitch of 30°.

(18)

6.2.2 Print the following labels on your drawing:

- Natural ground level (NGL)
- Finished floor level (FFL)
- Type of wall finishing
- Roof pitch
- Roof covering
- Title
- Scale

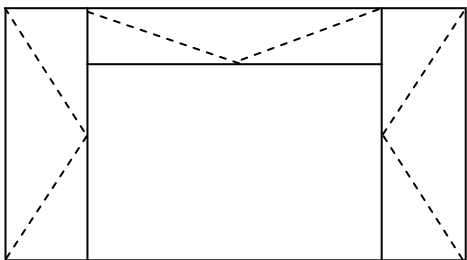
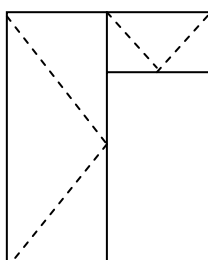
WINDOW SCHEDULE			
WINDOW 1 (W 1)		WINDOW 2 (W 2)	
			
WIDTH	HEIGHT	WIDTH	HEIGHT
3 000	1 500	1 000	1 500

FIGURE 6.3

(7)  
[40]

TOTAL: 200

<b>CENTRE NUMBER:</b>								
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<b>EXAMINATION NUMBER:</b>												
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**QUESTION 2.8****ANSWER SHEET 2.8**

DESCRIPTION	MARKS	MARKS OBTAINED
Wall thickness measurement	1	
Wall penetration measurement	1	
Wall drawn and labelled	1	
Concrete floor drawn and labelled	1	
Reinforcing mesh drawn and labelled	2	
Minimum concrete cover shown and labelled	1	
Floor thickness measurement	1	
Concrete symbol	1	
Scale (Accuracy of drawing)	1	
<b>Total</b>	<b>10</b>	

(10)

CENTRE NUMBER: 

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EXAMINATION NUMBER: 

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**QUESTION 4.1****ANSWER SHEET 4.1**

A	B	C	D
1/			Area of building:
			Inside length of long walls
			=
			=
2/			Length of skirting for long walls
			=
			=
			Inside length of short walls
			=
			=
2/			Length of skirting for short walls
			=
			=
			Total length of skirting required
			=
			=
1/			Volume of concrete for floor slab
1/			Cost of concrete

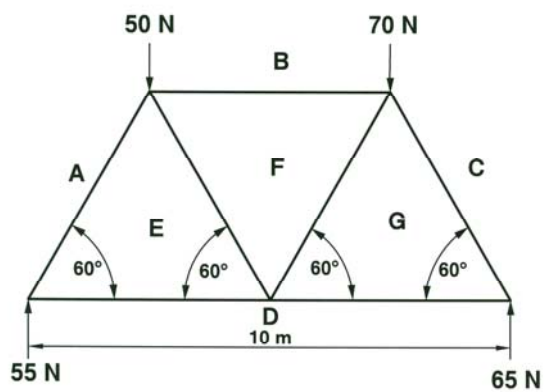
(10)

CENTRE NUMBER:

EXAMINATION NUMBER:

## QUESTION 5.2

## ANSWER SHEET 5.2



(1)

Space diagram

MEMBER	NATURE	MAGNITUDE
BF		34,6 N
CG	STRUT	
DG		37,5N
DE	TIE	

(4)

a

(9)

<b>CENTRE NUMBER:</b>								
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<b>EXAMINATION NUMBER:</b>													
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**QUESTION 6.1****ANSWER SHEET 6.1**

<b>No.</b>	<b>QUESTIONS</b>	<b>ANSWERS</b>	<b>MARKS</b>
<b>1</b>	What is the scale of the drawing?		1
<b>2</b>	Identify number 1.		1
<b>3</b>	Identify number 2.		1
<b>4</b>	Identify number 3.		1
<b>5</b>	Identify number 4.		1
<b>6</b>	Identify number 5.		1
<b>7</b>	What colour is used to indicate new brickwork on a drawing?		1
<b>8</b>	Identify number 6.		1
<b>9</b>	Identify number 7.		1
<b>10</b>	Identify number 8.		1
<b>11</b>	Identify number 9.		1
<b>12</b>	Identify number 10.		1
<b>13</b>	Identify number 11.		1
<b>14</b>	Identify number 12.		1
<b>15</b>	Draw freehand the symbol for a wash hand basin.		1

(15)

<b>CENTRE NUMBER:</b>								
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<b>EXAMINATION NUMBER:</b>														
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**QUESTION 6.2**

**ANSWER SHEET 6.2**

**FORMULA SHEET****IMPORTANT ABBREVIATIONS**

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
G	Centre of gravity	h	Height	d	Diameter
C	Centroid	b	Breadth/Width	r	Radius
L	Length	s	Side	A	Area
$\pi$	Pi = $\frac{22}{7}$ = 3,142	$\emptyset$	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	$l \times b$	$\frac{l}{2}$	$\frac{b}{2}$
Right-angled triangle	$\frac{1}{2} \times \text{base} \times \text{height}$	$\frac{1}{2}b \times h$	$\frac{b}{3}$	$\frac{h}{3}$
Equilateral triangle/ Pyramid	$\frac{1}{2} \times \text{base} \times \text{height}$	$\frac{1}{2}b \times h$	$\frac{b}{2}$	$\frac{h}{3}$
Circle	$\pi \times \text{radius} \times \text{radius}$	$\pi r^2$	Centroid is in the centre	
Circle	$\pi \times \text{diameter} \times \text{diameter} \div 4$	$\frac{\pi d^2}{4}$		
Semi-circle	$\pi \times \text{radius} \times \text{radius} \div 2$	$\frac{\pi r^2}{2}$	Centroid is 0,424r on the centre line	

$$\text{Position of centroid} = \frac{(A_1 \times d) + (A_2 \times d)}{\text{Total area}}$$

**OR**

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