



Province of the  
**EASTERN CAPE**  
EDUCATION

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**SEPTEMBER 2017**

**CIVIL TECHNOLOGY**

**MARKS: 200**

**TIME: 3 hours**



---

This question paper consists of 17 pages,  
including 4 answer sheets and a formula sheet.

---

**REQUIREMENTS:**

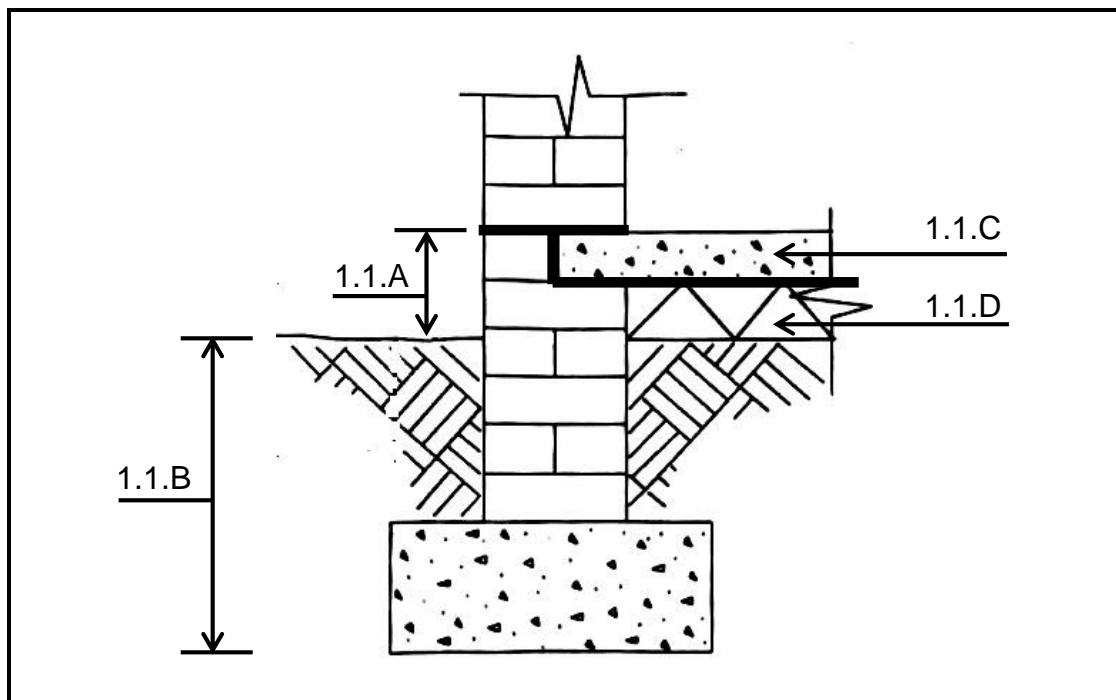
1. ANSWER BOOK
2. Drawing instruments
3. A non-programmable calculator

**INSTRUCTIONS AND INFORMATION**

1. This question paper consists of SIX questions.
2. ALL questions are COMPULSORY.
3. Answer each question as a whole. Do NOT separate subsections of questions.
4. Start EACH question on a NEW page.
5. You may use sketches 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 for the length of your answer.
8. Make drawing and sketches in pencil, fully dimensioned and neatly finished off with descriptive titles and notes, to conform to the *SANS (SABS) Recommended Practice for Building Drawings*.
9. For the purpose of this examination, the size of a brick should be taken as 220 mm x 110 mm x 75 mm.
9. Use your discretion where dimensions and/or details have been omitted.
10. Answer QUESTION 4.11, 4.12, 5.1, 5.2, 5.3, and 6.4 on the attached ANSWER SHEETS using drawing instruments where necessary.
11. Due to electronic transfer, drawings in the question paper are NOT to scale.

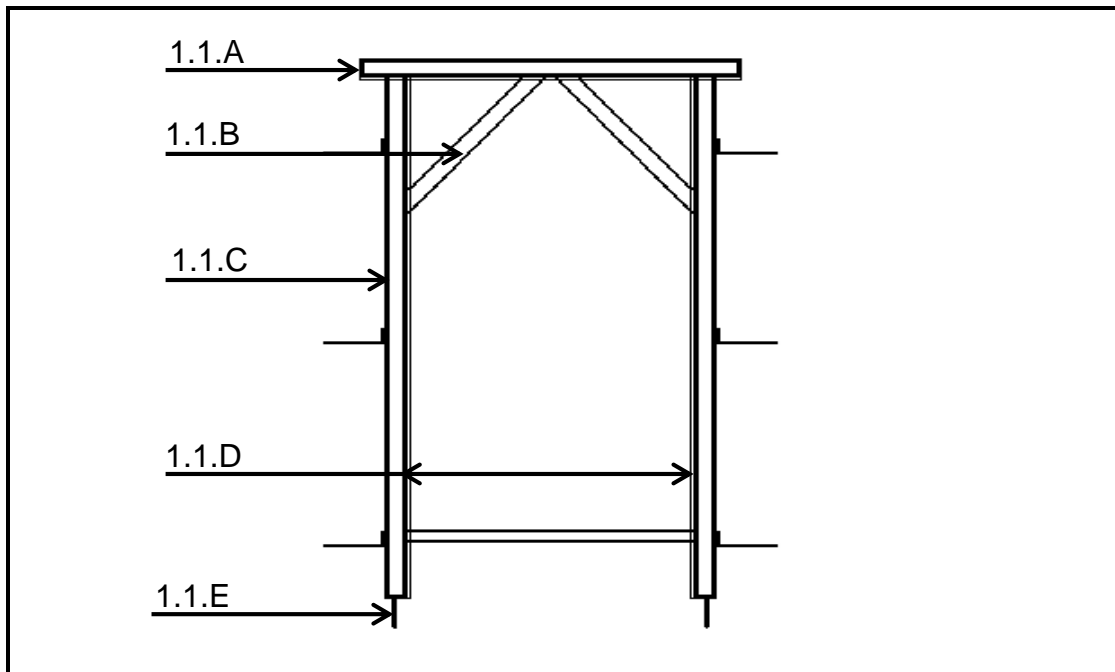
**QUESTION 1: CONSTRUCTION PROCESSES**

1.1 FIGURE 1.1 shows the substructure of a structure. Answer the following questions with regard to the construction in FIGURE 1.1.

**FIGURE 1.1**

- 1.1.1 What is the minimum measurement of the damp-proofing above the ground level at 1.1.A? (1)
- 1.1.2 What is the minimum measurement of the foundation bottom below ground at 1.1.B? (1)
- 1.1.3 What is the thickness of the wall construction in FIGURE 1.1? (1)
- 1.1.4 What type of material is the floor at 1.1.C manufactured from? (1)
- 1.1.5 What is part 1.1.D called? (1)
- 1.1.6 Name TWO purposes of part 1.1.D. (2 x 1) (2)
- 1.2 Briefly motivate why the water table level must be determined when an effective foundation for a structure is planned. (2)
- 1.3 Describe the advantage of holes in clay bricks during the baking process. (2)
- 1.4 Name THREE properties of face bricks. (3 x 1) (3)
- 1.5 Describe in point form the manufacturing process of clay bricks. (6)

1.6 FIGURE 1.6 shows a wooden door frame. Answer the following questions with regard to the door frame in FIGURE 1.6.



**FIGURE 1.6**

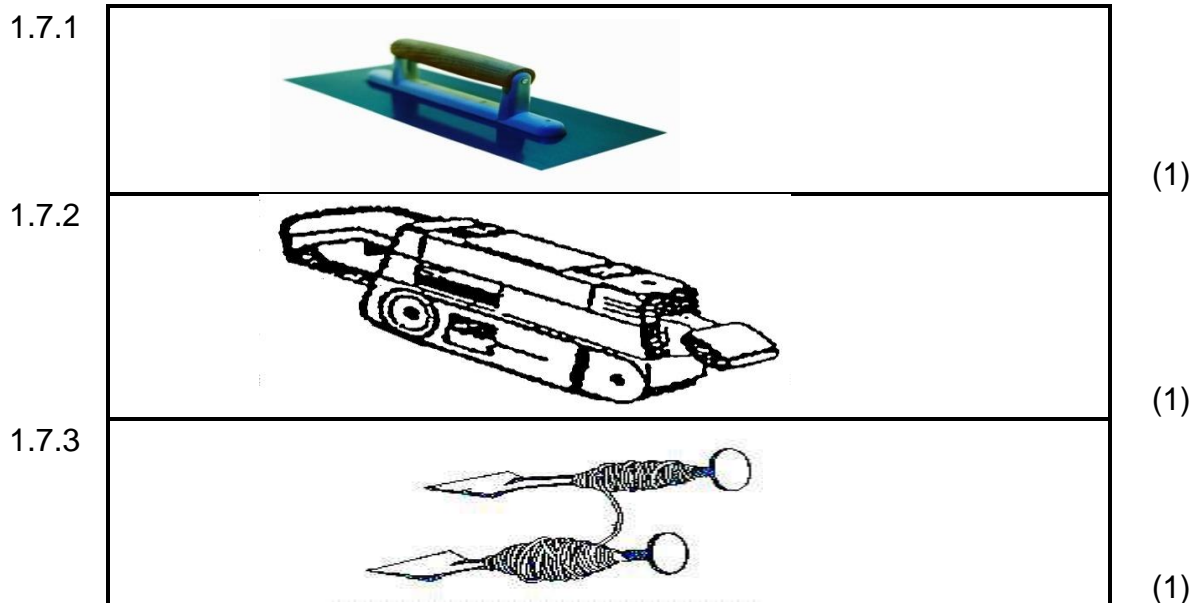
1.6.1 Briefly describe the method of building door frames into walls. (2)

1.6.2 Name parts 1.1.A to 1.1.C. (3)

1.6.3 What is the measurement of the door opening at 1.1.D? (1)

1.6.4 What is the purpose of the pegs at 1.1.E? (1)

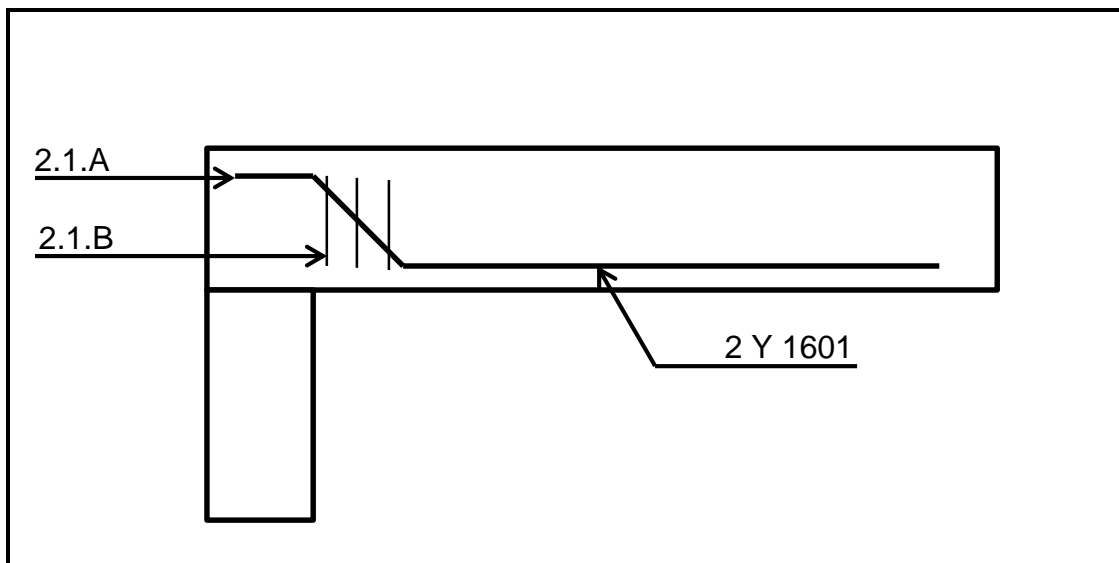
1.7 Name the tools in FIGURES 1.7.1 to 1.7.3.



**[30]**

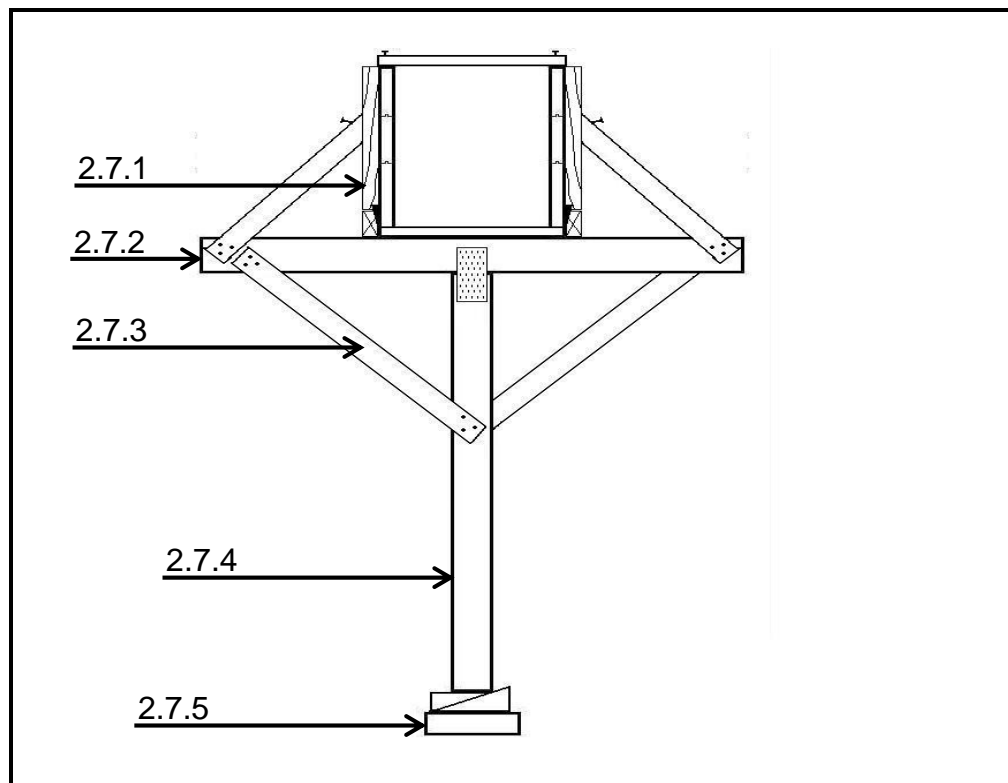
**QUESTION 2: ADVANCED CONSTRUCTION PROCESSES**

2.1 Answer the following questions with regard to the reinforced concrete beam in FIGURE 2.1.

**FIGURE 2.1**

- 2.1.1 What is bar 2.1.A called? (1)
- 2.1.2 What is the purpose of bar 2.1.A? (1)
- 2.1.3 From which type of steel is bar 2.1.A manufactured? (1)
- 2.1.4 What is the sectional size of bar 2.1.A? (1)
- 2.1.5 What are the bars at 2.1.B called? (1)
- 2.1.6 Name TWO purposes of the bars at 2.1.B. (2 x 1) (2)
- 2.2 Describe TWO requirements with which the steel for steel reinforcement must comply. (2 x 2) (4)
- 2.3 Briefly describe the purpose of efficient concrete covering for reinforced concrete. (2)
- 2.4 Briefly describe the difference between the type of bricks which are used for a rough arch and bricks that are used for a gauged arch. (2)
- 2.5 Briefly motivate why a clearance of 2 mm must be around the glass when it is fixed to a frame. (2)
- 2.6 Name THREE safety rules to be observed when working on floors and stairs with open sides. (3 x 1) (3)

2.7 Name the parts of beam the shuttering in FIGURE 2.7.



**FIGURE 2.7**

(5)

2.8 Make a neat sectional sketch to illustrate the construction of an open eave construction. The following parts must be indicated in the sketch: outer wall, rafter, tie beam, fascia board (gutter board), 2 purlines, tile roof covering and beam filling.

(8)

2.9 Briefly describe the purpose of a raking shore.

(2)

2.10 Indicate whether the following statements are TRUE or FALSE.

Write only the word 'true' or 'false' next to the number in the ANSWER BOOK.

2.10.1 Trestles are used to support walls.

(1)

2.10.2 Scaffolds for high buildings must be assembled at an angle of 5°.

(1)

2.10.3 High scaffolds must be attached to a building.

(1)

2.10.4 Scaffolds should not be moved while workers are still on it.

(1)

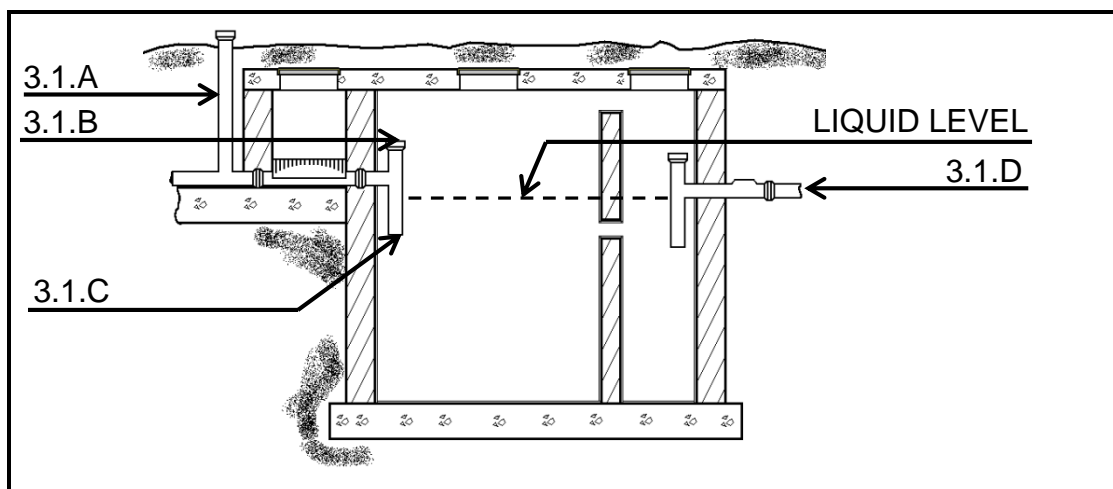
2.10.5 The depth of kitchen units is 900 mm.

(1)

**[40]**

**QUESTION 3: CIVIL SERVICES**

3.1 Answer the following questions with regard to the drainage structure in FIGURE 3.1.



**FIGURE 3.1**

- 3.1.1 What is the structure called? (1)
- 3.1.2 Briefly describe how the organic matter decomposes in the structure. (2)
- 3.1.3 What is the purpose if the inlet pipe opening at 3.1.B? (1)
- 3.1.4 Briefly motivate why the inflow at 3.1.B must be lower than the liquid level. (2)
- 3.1.5 To which structure is the effluent at 3.1.D discharged? (1)
- 3.2 Briefly describe the disadvantageous effects in a drain system when it is not equipped with a ventilation pipe. (2)
- 3.3 Make a neat sketch to illustrate the construction of an S-trap. (3)
- 3.4 Identify the correct answer in each of the following descriptions of the drain test methods. Write only the correct word next to the number in the ANSWER BOOK.
- 3.4.1 The mirror and torch test check that the drain pipe is **STRAIGHT / SEALED**. (1)
- 3.4.2 The ball of the ball test must be **10 mm / SLIGHTLY SMALLER** than the diameter of the pipe. (1)
- 3.4.3 If the drop in the water level is greater than **16 mm / 6 mm**, the pipe probably has a leak. (1)
- 3.5 Name THREE methods of generating electricity. (3 x 1) (3)

- 3.6 What is the purpose of the conduit pipes in an electrical system? (1)
- 3.7 Briefly describe what an *indirect water supply system* is. (3)
- 3.8 What is the water supply pipe from the water service point to the dwelling called? (1)
- 3.9 Indicate whether the following statements with regard to solar heating systems are TRUE or FALSE. Write only the word 'true' or 'false' next to the number in the ANSWER BOOK.
- 3.9.1 The hot water of the independent solar heating system is stored in the geyser. (1)
- 3.9.2 The tray of the solar heating system is coated with an isolation material. (1)
- 3.9.3 The inside of the tray of the solar heating system is coated with white paint to reflect the sun's rays. (1)
- 3.9.4 The best position for the sun collector is due east. (1)
- 3.9.5 Photovoltaic cells can also be used to heat the water. (1)
- 3.10 Answer the following questions with regard to the tap in FIGURE 3.10.

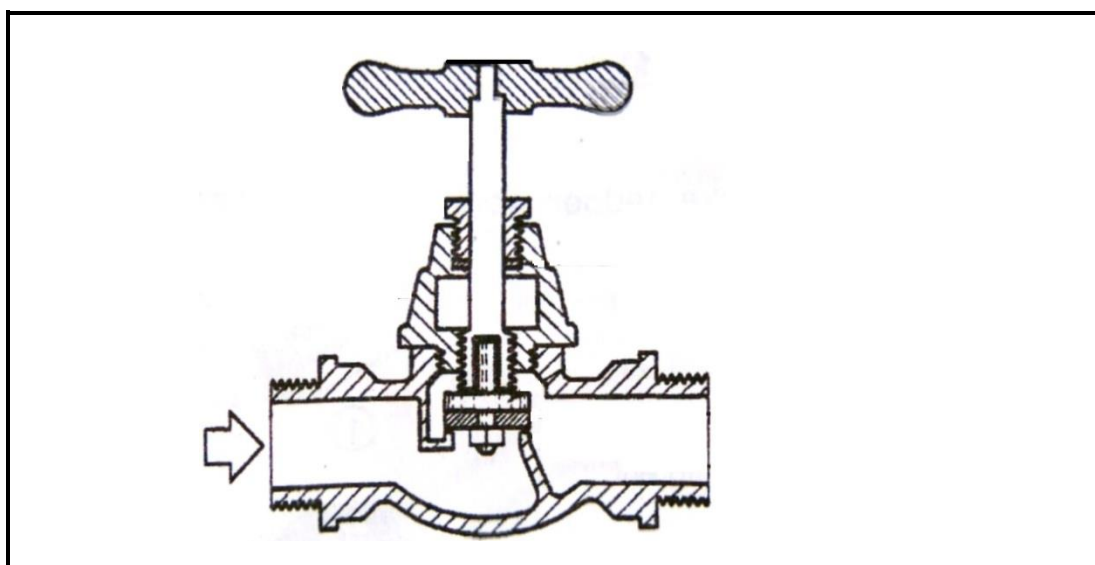


FIGURE 3.10

- 3.10.1 What is this type of tap called? (1)
- 3.10.2 Give ONE example where this type of tap must be installed. (1 x 1) (1)
- [30]**



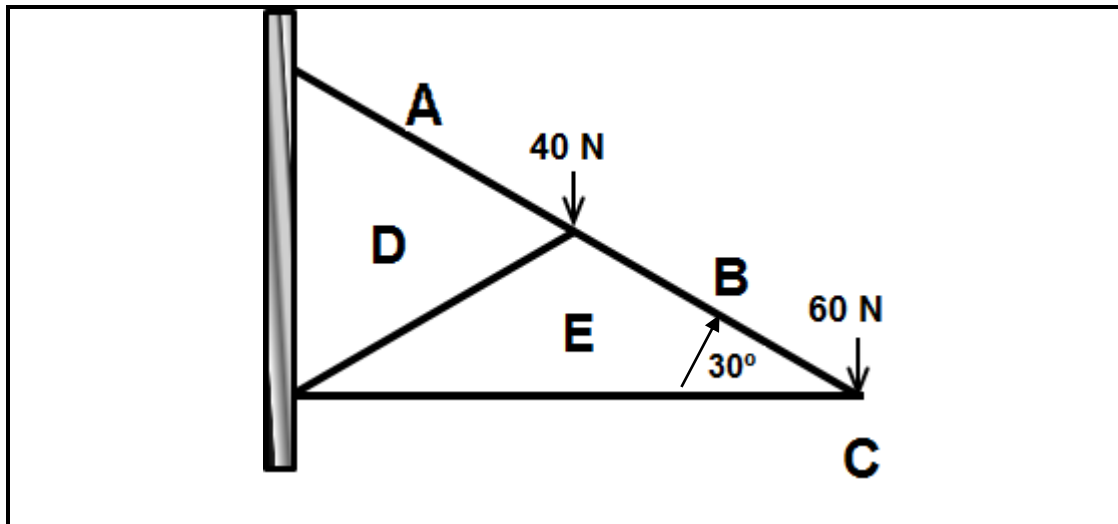
**QUESTION 4: MATERIALS AND QUANTITIES**

- 4.1 Name TWO reactions which take place during the hydration process of cement. (2 x 1) (2)
- 4.2 Briefly motivate why cement must not be stored longer than three months. (2)
- 4.3 Name ONE purpose of lime in a mortar mix. (1 x 1) (1)
- 4.4 Which ingredient is first put into the concrete mixer when concrete must be mixed? (1)
- 4.5 Name THREE methods that can be used for curing concrete. (3 x 1) (3)
- 4.6 Briefly motivate why the cube test must be performed on concrete. (2)
- 4.7 Name TWO uses of each of the following materials in the construction trade:
- 4.7.1 Copper (2 x 1) (2)
- 4.7.2 Zink (2 x 1) (2)
- 4.8 Make a neat sketch to illustrate the profile of channel iron. (2)
- 4.9 Name THREE properties of a good preservative for wood. (3 x 1) (3)
- 4.10 Briefly describe the composition of plywood. (2)
- 4.11 Use the quantity list on ANSWER SHEET A and determine the volume of concrete which will be needed for a floor with a length of 6 m, width of 3 m and thickness of 75 mm. (3)
- 4.12 Use the quantity list on ANSWER SHEET A and determine the number of bricks which will be needed for a cavity wall with a length of 4 m and a height of 2,4 m. (5)

**[30]**

**QUESTION 5: APPLIED MECHANICS**

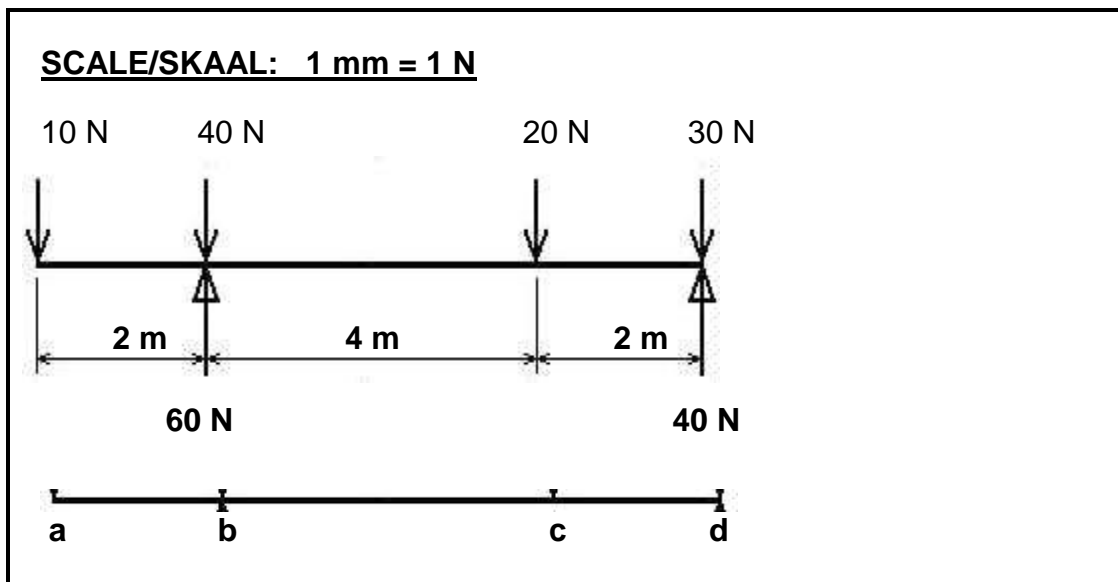
- 5.1 FIGURE 5.1 on ANSWER SHEET B shows the space diagram of a lean-to roof. Determine graphically on **scale 1 mm = 1 N** on ANSWER SHEET B the size and nature of the forces in the parts of the truss by drawing the force diagram and completing the table.



(14)

**FIGURE 5.1**

- 5.2 FIGURE 5.2 on ANSWER SHEET C shows a beam with point loads. Calculate, on ANSWER SHEET C, the following:

**FIGURE 5.2**

- 5.2.1 The bending moment values (6)
- 5.2.2 Complete the bending moment diagram on **scale 1 mm = 1 N** according to the bending moment values (4)

- 5.3 Determine, from point **P**, the centroid of the body in FIGURE 5.3.  
(The table on ANSWER SHEET C can be used for the calculations.)

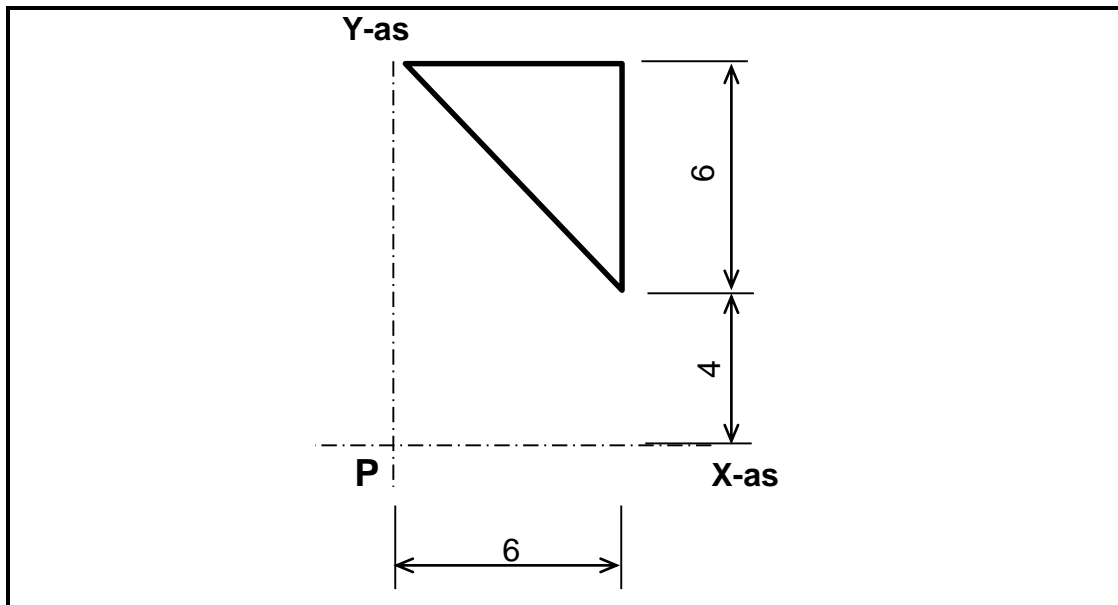


FIGURE 5.3

(6)  
[30]

**QUESTION 6: GRAPHICS AND COMMUNICATION**

- 6.1 Name FOUR responsibilities of the architect which must be reflected in the sketch drawings of the design of a structure. (4 x 1) (4)
- 6.2 Make neat sketches to illustrate the following symbols:
- 6.2.1 Water closet (2)
  - 6.2.2 Sink (2)
  - 6.2.3 Water meter (2)
- 6.3 In which working drawing is the entrance to a site indicated? (1)
- 6.4 FIGURE 6.4 on SHEET D shows the floor plan of a store room on scale 1 : 50. Draw, on SHEET D, the south elevation on scale 1 : 50 from the given ground level line by using the following information:
- The floor level above the ground level: 200 mm
  - Wall height from the floor level to the ceiling: 2 600 mm
  - Window 1 : 600 x 2 100 mm
  - Door 1 : 1 400 x 2 100 mm
  - Door knob
  - Roof construction pitch: 30°
  - Indicate construction lines to determine the roof height
  - Gable end at west elevation
  - Hipped roof at east elevation

Use the marks table on ANSWER SHEET D as reference. (29)  
**[40]**

**TOTAL: 200**

<b>ANTWOORDBLAD</b> <b>ANSWER SHEET</b>	<b>A</b>	<b>SIVIELE TEGNOLOGIE</b>	<b>NAAM:</b> _____
		<b>CIVIL TECHNOLOGY</b>	<b>NAME:</b> _____

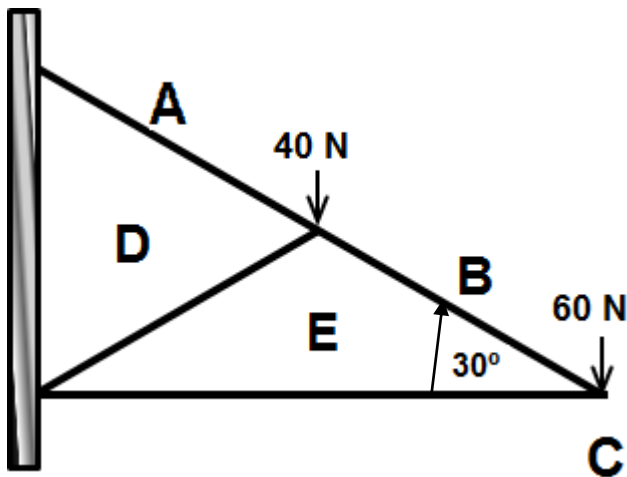
4.11 Use the quantity list on ANSWER SHEET A and determine the volume of concrete which will be needed for a floor with a length of 6 m, width of 3 m and thickness of 75 mm. (3)

4.12 Use the quantity list on ANSWER SHEET A and determine the number of bricks which will be needed for a cavity wall with a length of 4 m and a height of 2,4 m. (5)

A	B	C	D



<b>ANTWOORDBLAD</b> <b>ANSWER SHEET</b>	<b>SIVIELE TEGNOLOGIE</b> <b>CIVIL TECHNOLOGY</b>	<b>NAAM:</b> _____ <b>NAME:</b> _____
--------------------------------------------	------------------------------------------------------	------------------------------------------

**VRAAG/QUESTION 5.1****RUIMTEDIAGRAM/SPACE DIAGRAM:****KRAGTEDIAGRAM/FORCE DIAGRAM****SKAAL/SCALE: 1 mm = 1 N**

DEEL/ PART	Grootte/ Size	Aard/Nature	
		↔	→←
AD			
BE			
CE			
DE			

Akkuraatheid / Accuracy

(14)





<b>ANTWOORDBLAD</b> <b>ANSWER SHEET</b>	<b>SIVIELE TEGNOLOGIE</b> <b>CIVIL TECHNOLOGY</b>	<b>NAAM:</b> _____ <b>NAME:</b> _____
--------------------------------------------	------------------------------------------------------	------------------------------------------

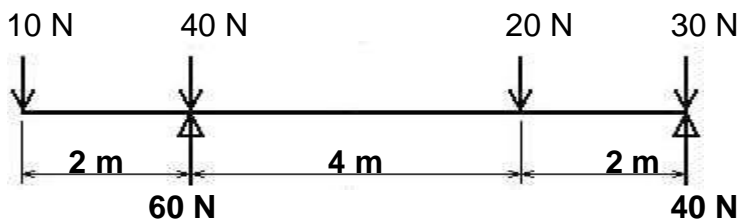
**VRAAG/QUESTION. 5.2**

5.2.1 Die buigmomentwaardes/The bending moment values (4)

- a = .....  
 b = .....  
 c = .....  
 d = .....

5.2.2 FIGUUR 5.2: Die buigmomentdiagram/The bending moment diagram (4)


SKAAL/SCALE: 1 mm = 1 N



**FIGUUR 5.2**

**VRAAG/QUESTION 5.3**

(6)

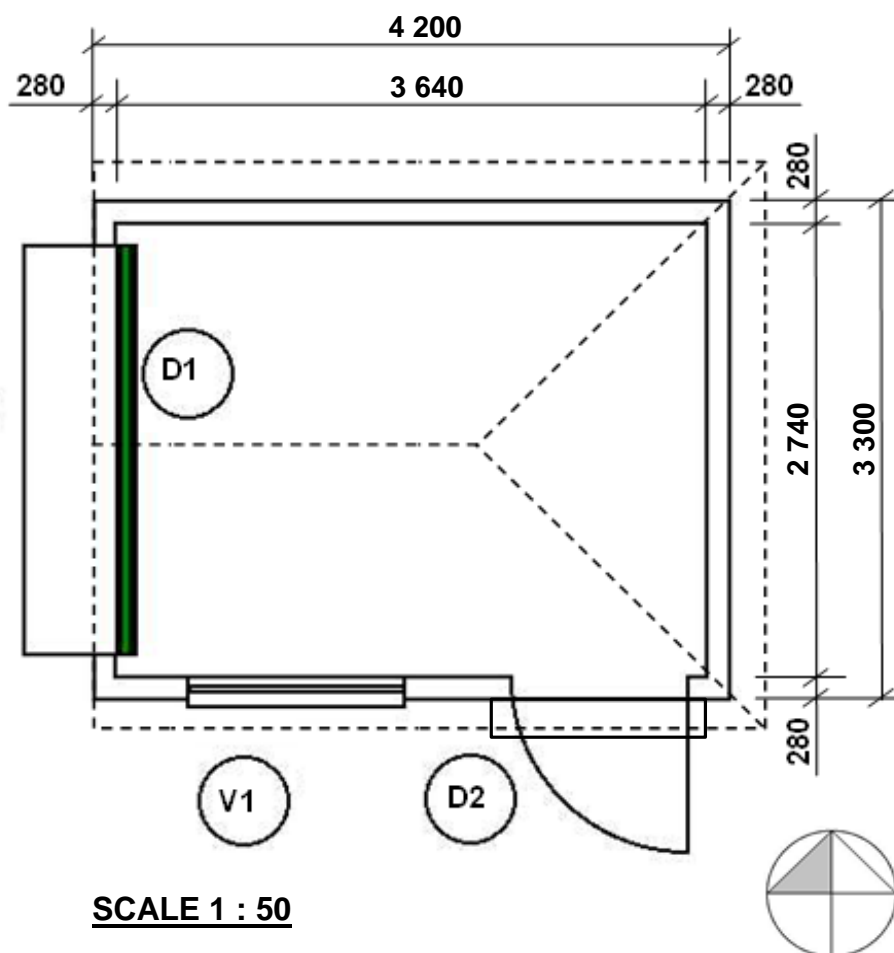
Vorm / Shape	X	Y
		



<b>ANTWOORDBLAD</b> <b>ANSWER SHEET</b>	<b>D</b>	<b>SIVIELE TEGNOLOGIE</b> <b>CIVIL TECHNOLOGY</b>	<b>NAAM:</b> _____ <b>NAME:</b> _____
--------------------------------------------	----------	------------------------------------------------------	------------------------------------------

**VRAAG/QUESTION 6.4**

(26)

**SCALE 1 : 50**

Floor level	2	
Wall	3	
Window	3	
Window sill	1	
Door	4	
Step	1	
Ramp	1	
Facia board	2	
Gutter	1	
Down pipe	1	
Gable end	4	
Hipped roof	3	
Roof height	3	
<b>TOTAL</b>	<b>29</b>	



**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	Length x Breadth	$l \times b$	$\frac{b}{2}$	$\frac{b}{2}$
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	$\pi \times \text{diameter} \times \text{diameter divided by 4}$	$\frac{\pi d^2}{4}$		
Semi-circle	$\pi \times \text{radius } r \times \text{radius divided by 2}$	$\frac{\pi r^2}{2}$	Centroid is $0,424r$ on the centre line	

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

