basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

CIVIL TECHNOLOGY

EXEMPLAR 2014

MARKS: 200

TIME: 3 hours

This question paper consists of 16 pages, 6 answer sheets and a formula sheet.

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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. You may use sketches to illustrate your answers.
7. Write ALL calculations and answers 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 Drawings*.
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 3.4, 4.1, 5.2.1, 5.2.2, 5.2.3, 5.3.2, 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.

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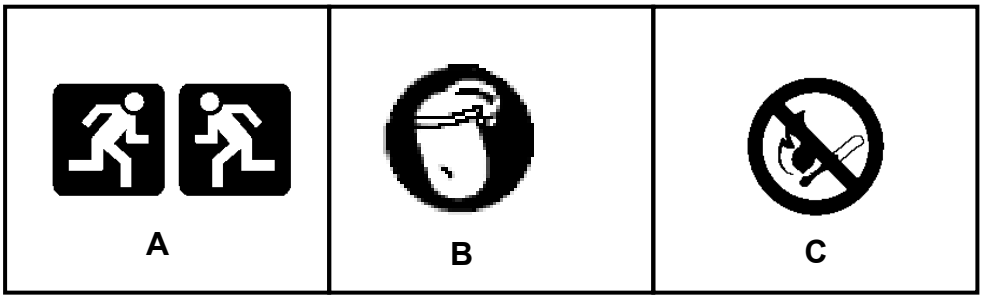
QUESTION 1: CONSTRUCTION, SAFETY AND MATERIAL

1.1 The pictures below show safety signs used on a building site.



1.1.1 Identify the safety signs as illustrated in **A**, **B** and **C**. (3)

1.1.2 Recommend ONE specific instance where you will use the safety signs in **A**, **B** and **C** respectively. (3)

1.2 Define the following terms as used in concrete:

1.2.1 Segregation (1)

1.2.2 Slump (1)

1.2.3 Compaction (1)

1.3 Cement is an important material and has a short shelf life.

1.3.1 Explain how you will store cement on a construction site. (2)

1.3.2 Why is it important to protect your hands when working with cement? (1)

1.3.3 How would you protect workers from inhaling cement dust? (1)

1.4 Describe THREE safety precautions that must be taken into consideration when using hand tools. (3)

1.5 What steps will you take to apply first aid if a worker cuts himself/herself accidently and starts bleeding? (2)

1.6 Illustrate, by means of line diagrams, the difference between a South African (Howe) and the W (Fink) roof truss. (4)

1.7 Name TWO materials that can be cut with an angle grinder installed with masonry grinding blades. (2)

1.8 What is the minimum distance that a damp-proof course must be installed above ground level? (1)

1.9 An elevation of a double casement window within a frame is shown in FIGURE 1.9. Write down the letters **A** to **E** in your ANSWER BOOK and the correct names of the components next to the corresponding letter.

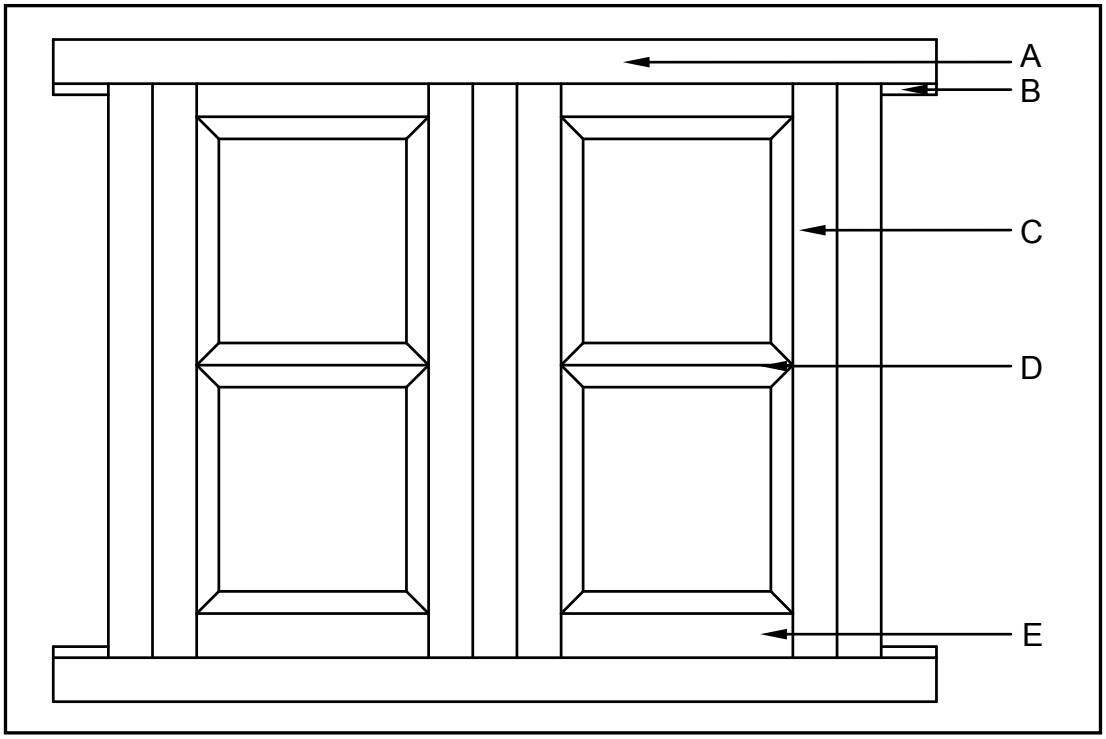


FIGURE 1.9

(5)
[30]

QUESTION 2: ADVANCED CONSTRUCTION AND EQUIPMENT

START THIS QUESTION ON A NEW PAGE.

2.1 FIGURE 2.1 shows three steps of driving a pile into the ground.

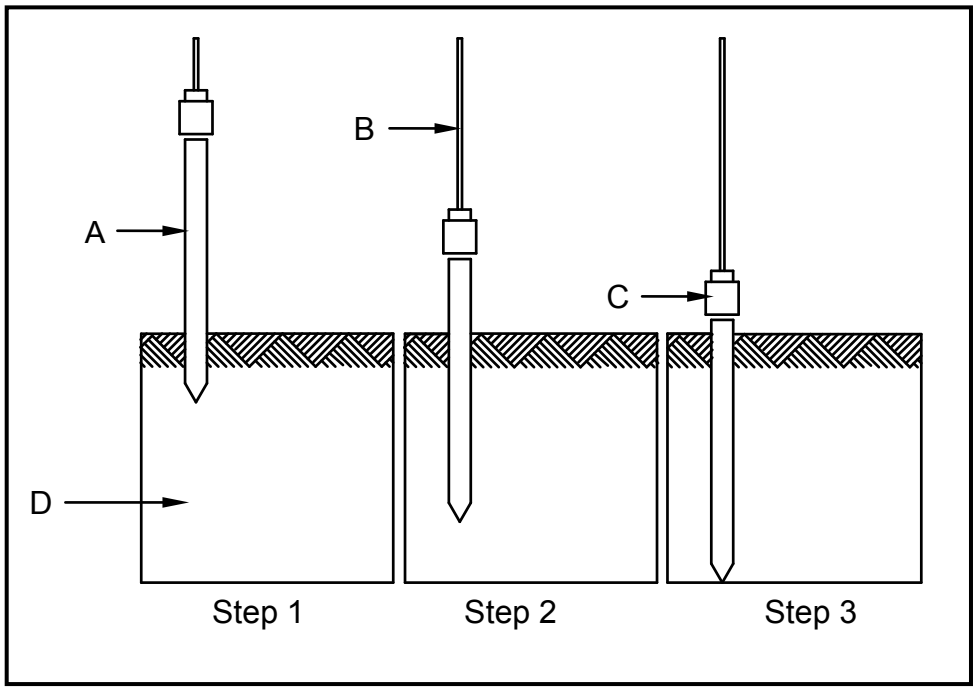


FIGURE 2.1

2.1.1 Write down the letters **A** to **C** in your ANSWER BOOK and the correct name of the part next to it. (3)

2.1.2 Describe the type of soil structure (**D**) where piles are used. (2)

2.2 Compare strip foundations and pile foundations according to the criteria given in the table below. Redraw the table in your ANSWER BOOK and tabulate your answer.

CRITERIA	STRIP FOUNDATION	PILE FOUNDATION
Advantage		
Equipment used for digging foundation		

(4)

2.3 Explain what purpose the hand tools below will serve during the manufacturing of roof trusses.

2.3.1 Square (1)

2.3.2 Claw hammer (1)

2.4 Identify the type of steel in FIGURE 2.4 that is used for reinforcing.

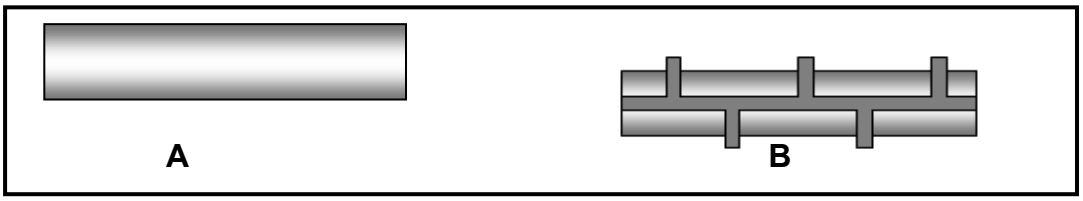


FIGURE 2.4 (2)

2.5 Explain the difference between a *rough arch* and *gauged arch*. (2)

2.6 The steps for concealing the joints of dry wall construction is shown in FIGURE 2.6 and also listed in the table below. The steps are NOT listed in the correct order.

	STEPS
A	Apply a second layer of gypsum plaster on top of the self-adhesive gauze.
B	When the joint is dry, sand lightly with fine sandpaper.
C	Apply first layer of gypsum plaster to joints.
D	Apply thin final coat of gypsum plaster and let it dry.
E	Apply self-adhesive gauze to cover an equal area on either side of the joint.

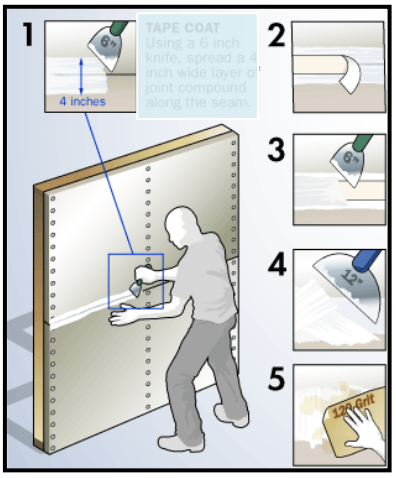


FIGURE 2.6
[Source: home.howstuffworks.com]

2.6.1 Rearrange the steps in the correct order by writing numbers **1** to **5** in your ANSWER BOOK and the corresponding letter of the correct step next to it. (5)

2.6.2 Name TWO advantages of dry wall construction. (2)

2.7 National building regulations require that a building should be moisture proof. Explain why it is important that a building must be moisture proof. (3)

2.8 FIGURE 2.8 shows the lower part of a concrete column construction that has failed. Explain THREE possible reasons that could have caused the failure.

FIGURE 2.8 (3)

2.9 FIGURE 2.9 is a sketch showing the layout of a concrete floor.

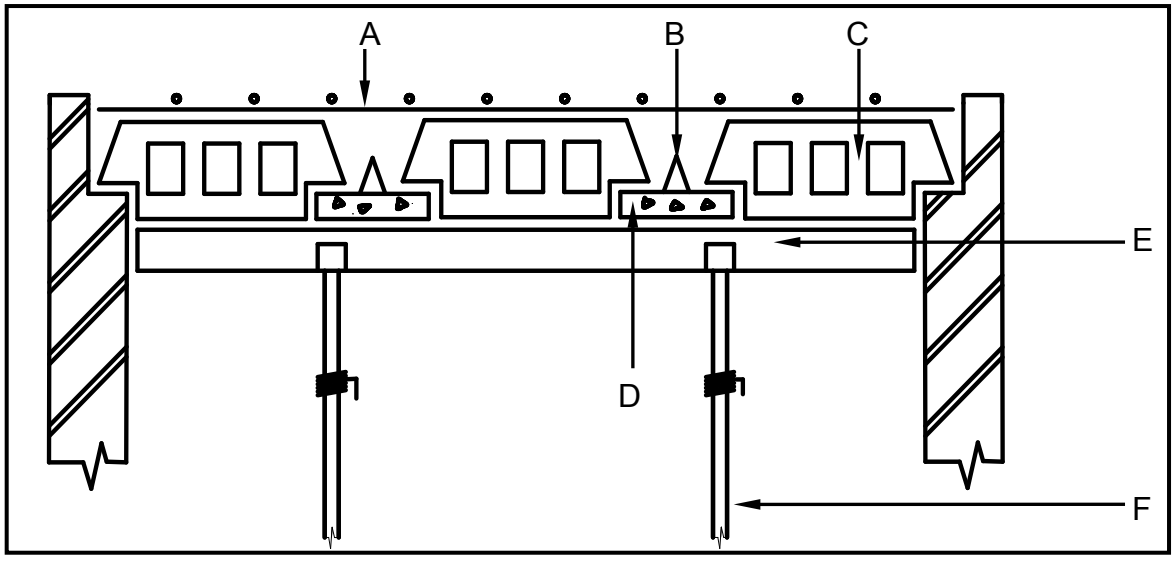


FIGURE 2.9

2.9.1 Write down the letters **A** to **F** in your ANSWER BOOK and write the correct name of the components next to it. (6)

2.9.2 Explain the purpose of components **E** and **F** as used in FIGURE 2.9. (2)

2.9.3 What is the type of floor construction in FIGURE 2.9 called? (1)

2.9.4 Justify why you would rather use the type of floor construction in FIGURE 2.9 than an in-situ cast suspended floor. (3)

[40]

QUESTION 3: CIVIL SERVICES

START THIS QUESTION ON A NEW PAGE.

3.1 Redraw the table below in your ANSWER BOOK and explain THREE advantages and THREE disadvantages of galvanised pipes used for water supply.

ADVANTAGES	DISADVANTAGES
(a)	(a)
(b)	(b)
(c)	(c)

(6)

3.2 FIGURE 3.2 shows the top view of a part of a sewerage system. Consider the illustration and answer the questions that follow.

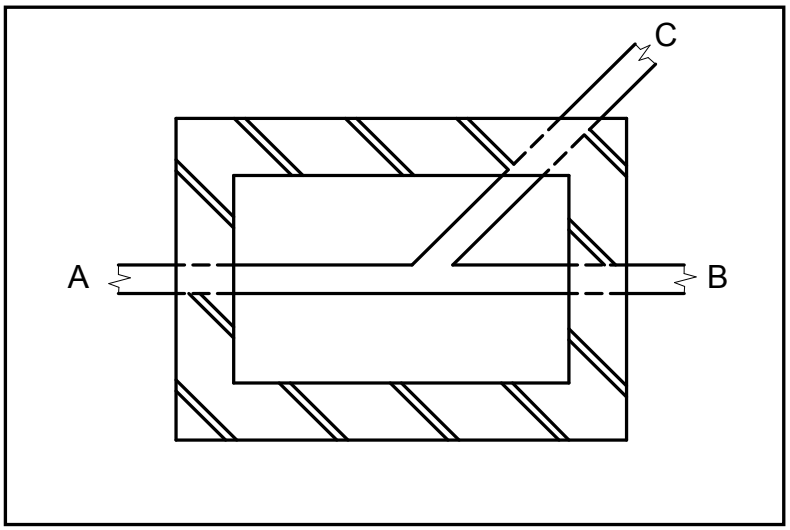


FIGURE 3.2

3.2.1 Identify the sewer component shown in FIGURE 3.2. (1)

3.2.2 Describe from which direction the sewage will flow: from **A** to **B** and **C** OR from **B** and **C** to **A**. (1)

3.2.3 Is the junction in this sewer component open or a solid (closed) pipe? Give a logical reason for your answer. (1)

3.2.4 Where in a sewerage system will you install this component? (1)

3.2.5 How far apart from each other will you install this component in a sewerage system, taking into consideration that the sewer line is straight with no branch pipes? (1)

3.2.6 What other component can be used in a domestic sewerage system instead of the component in FIGURE 3.2? (1)

3.3 Write down the abbreviations for the following:

3.3.1 Invert level (1)

3.3.2 Vent pipe (1)

3.3.3 Distribution box (1)

3.4 ANSWER SHEET 3.4 shows the floor plan of a dwelling.

3.4.1 Use ANSWER SHEET 3.4 and design a sewerage system and draw the sewerage (drainage) plan for the building, taking into consideration regulations and design principles of a good sewerage system. Indicate ALL sewerage abbreviations where applicable. (8)

3.4.2 Write the abbreviations for all the sanitary fitments shown on the plan. (4)

3.4.3 On the drawing on ANSWER SHEET 3.4, write the diameter of the pipe, gradient of the pipe and the type of material used for the sewerage pipes. (3)
[30]

QUESTION 4: QUANTITIES, MATERIALS AND JOINING

START THIS QUESTION ON A NEW PAGE.

4.1 FIGURE 4.1 shows the floor plan of a storeroom with a hipped roof.

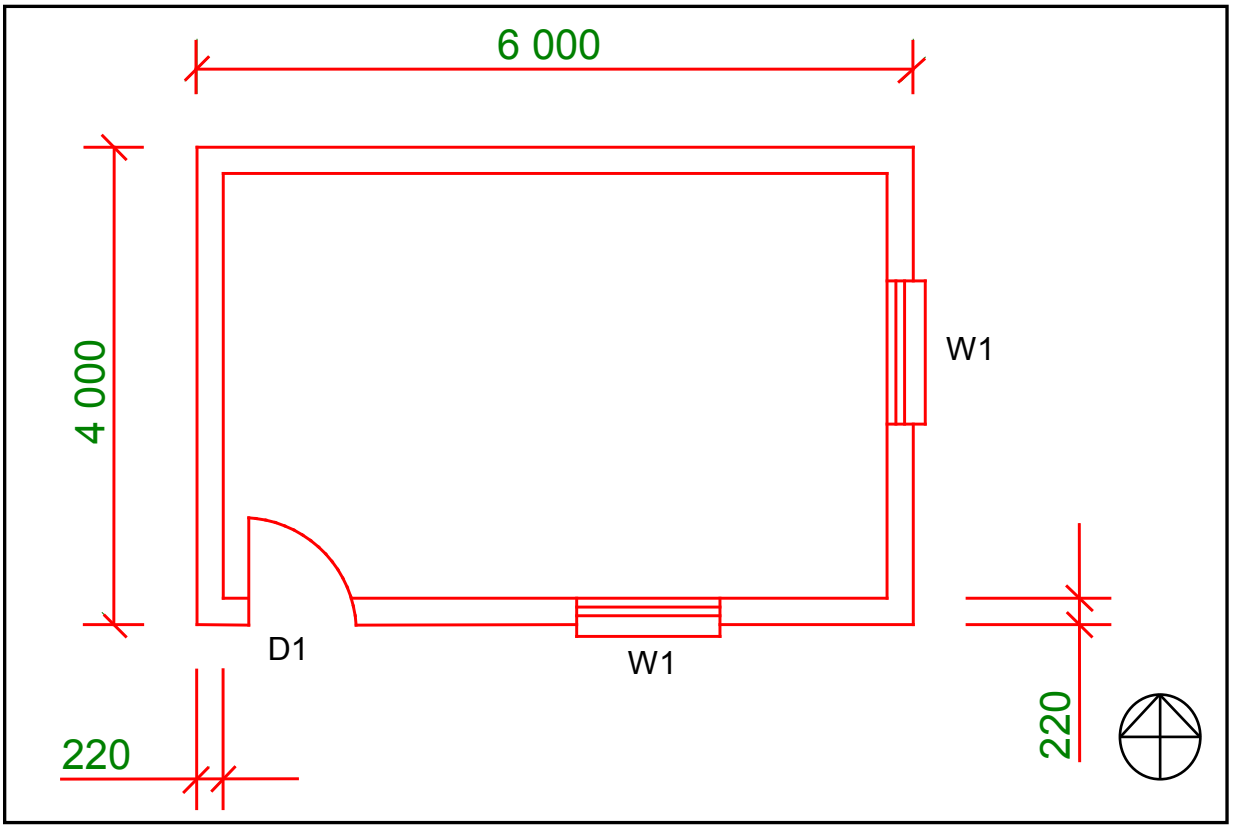


FIGURE 4.1

Specifications:

- 110 bricks are required to build one square metre of a 220 mm thick wall.
- Window 1 (W1) is 1 500 mm wide and 1 200 mm high.
- The opening of D1 is 900 mm wide and 2 000 mm high.
- The height of the wall is 2 700 mm (superstructure only).

Use the specifications above and calculate the following on ANSWER SHEET 4.1:

4.1.1 The total area of the wall on the southern side of the building, including the window and door openings (before deductions) (3)

4.1.2 The area of Window 1 (3)

4.1.3 The area of Door 1 (3)

4.1.4 The total wall area, excluding the window and the door (3)

4.1.5 The total number of bricks required to build the wall, including 5% for wastage and breakages (3)

4.2 Copper pipes can be joined by using capillary or compression joints.

4.2.1 Describe the different type of materials that are used to keep the pipes from moving apart for each of the joints. (2)

4.2.2 Name TWO tools that you will use to tighten a compression joint. (2)

4.3 Cabinets are fixed onto brick walls. Name TWO types of anchors that can be used to fix a cabinet to brickwork. (2)

4.4 You must fill a cube mould with fresh concrete for a cube test. Explain the process of how the cubes are prepared and filled with concrete. (4)

4.5 What is the purpose of the slump test on concrete? (1)

4.6 FIGURE 4.6 shows the profiles of various steel sections.

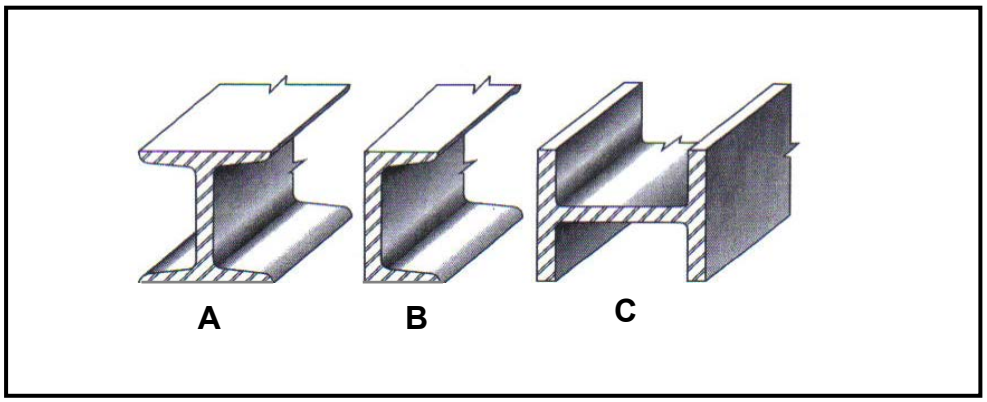


FIGURE 4.6

Explain ONE use of each of the above sections as used in steel structures. Write down **A**, **B** and **C** in your ANSWER BOOK and your answer next to it. (3)

4.7 Explain ONE precaution you will take to prevent steel from corroding. (1)

[30]

QUESTION 5: APPLIED MECHANICS

START THIS QUESTION ON A NEW PAGE.

5.1 FIGURE 5.1 shows a lamina. Calculate the position of the centroid of the lamina from B-B.

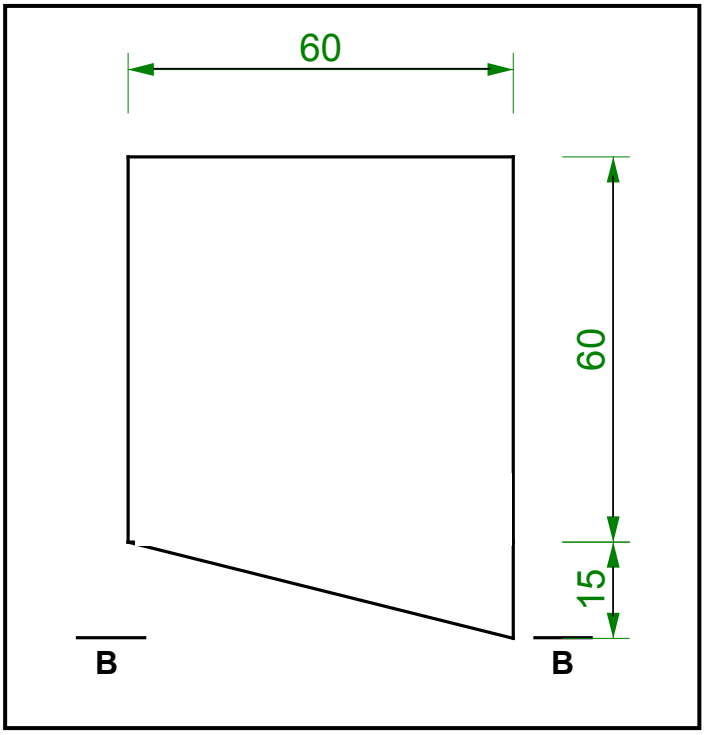


FIGURE 5.1

(9)

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

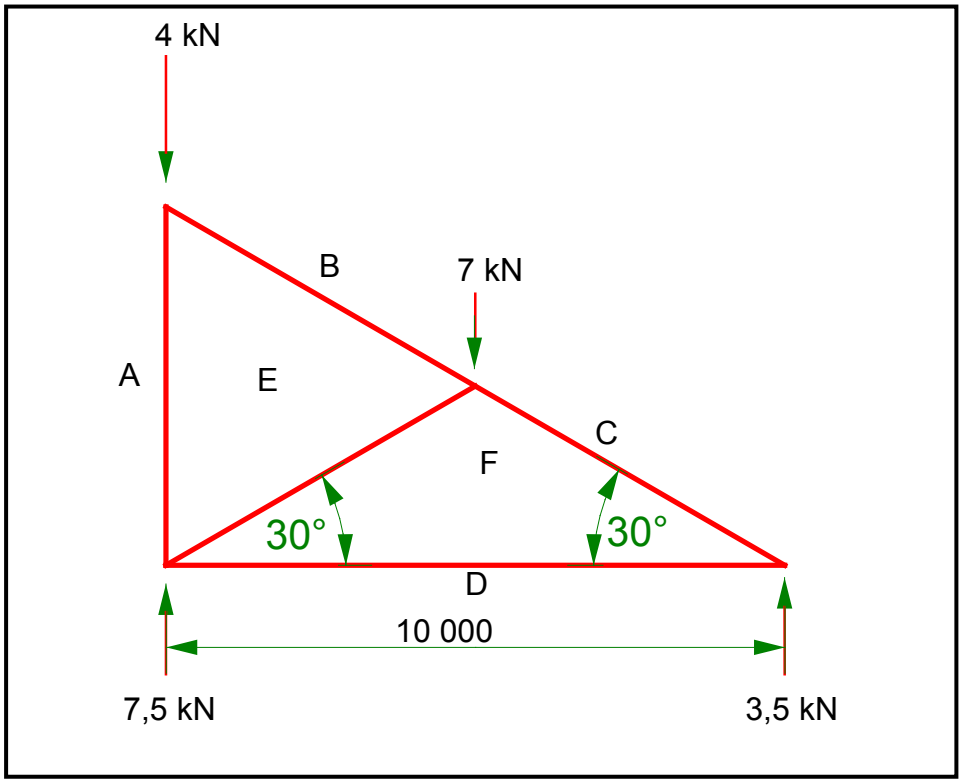


FIGURE 5.2

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. (4)

5.2.2 Graphically determine the nature and magnitude of the forces in all the members of the framework. Complete the table on ANSWER SHEET 5.2. (6)

5.2.3 Show on ANSWER SHEET 5.2 the nature of parts AE and EF on the space diagram with the use of arrows. (2)

5.3 FIGURE 5.3 shows a beam of 8 metres resting on two supports. The beam carries a uniformly distributed load of 20 N/m and one point load.

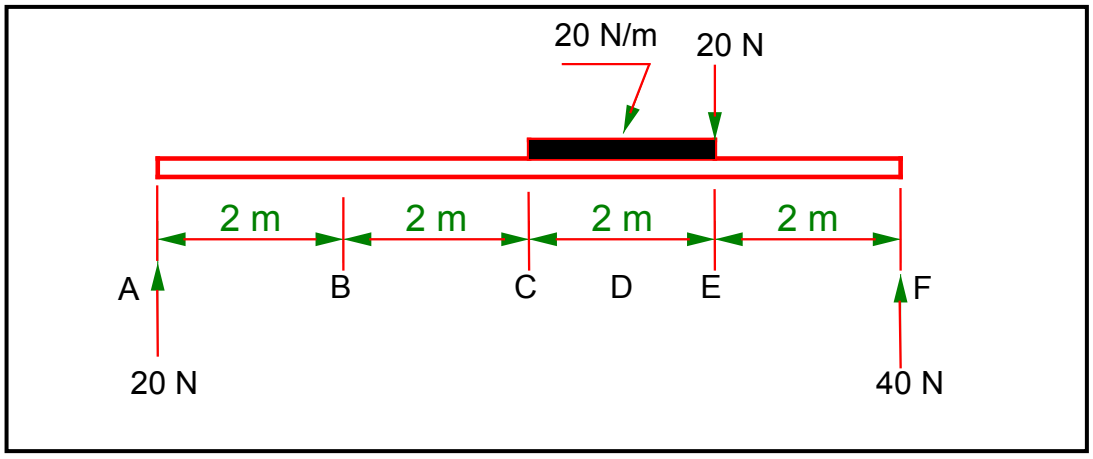


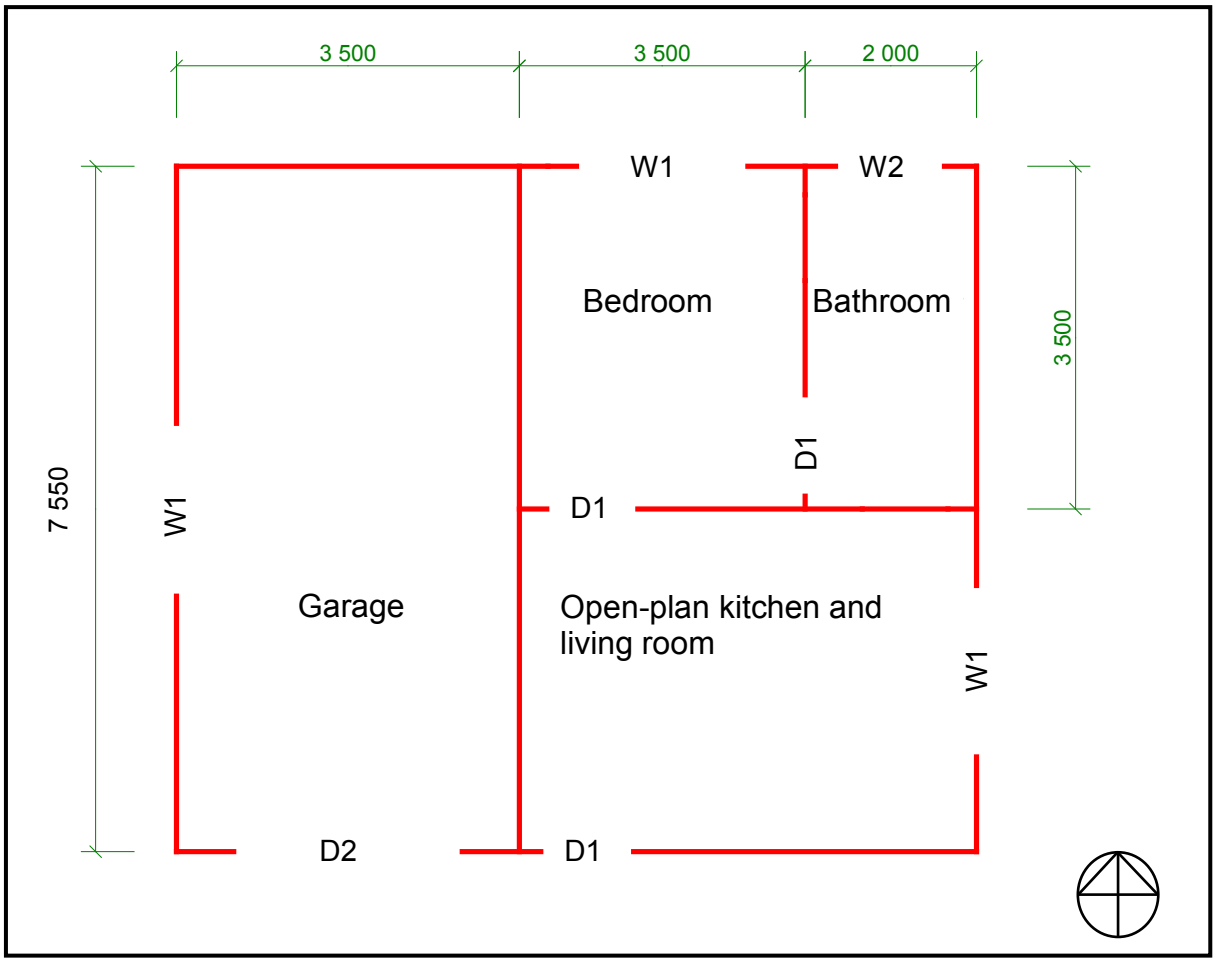
FIGURE 5.3

5.3.1 Calculate the shear force at **A**, **B**, **C**, **E** and **F**. (5)

5.3.2 Draw the shear force diagram to scale 1 N = 1 mm on ANSWER SHEET 5.3. (4)
[30]

QUESTION 6: GRAPHIC COMMUNICATION

6.1 A line diagram of the floor plan of a building is shown in FIGURE 6.1. All dimensions shown on the drawing indicate the inside measurements of the rooms.



FIGUUR 6.1

Specifications:

	WIDTH	HEIGHT
Window 1 (W1)	2 000 mm	1 200 mm
Window 2 (W2)	600 mm	900 mm
Door 1 (D1)	900 mm	2 000 mm
Roll-up garage door (D2)	2 500 mm	2 000 mm

6.1.1 Draw the floor plan of the building to scale 1 : 50 on ANSWER SHEET 6.1. All external walls are 220 mm and internal walls 110 mm wide. (7)

6.1.2 Draw the windows and doors on the floor plan in the spaces as indicated on the line diagram. (8)

6.1.3 Draw the drawing symbol for a water closet, washbasin and shower in the bathroom, a sink in the kitchen and a built-in cupboard in the bedroom. (5)

6.1.4 Design and draw a hipped roof on the floor plan on ANSWER SHEET 6.1. (5)

6.1.5 Show any ONE dimension on the eastern side of the building. (1)

6.1.6 Print the title and scale below the drawing. (2)

6.1.7 ONE mark will be allocated for accuracy and ONE mark for neatness. (2)

6.2 The drawing on ANSWER SHEET 6.2 shows the west and south elevation of a building. Analyse the drawing and complete the table on ANSWER SHEET 6.2. (10)
[40]

TOTAL: 200

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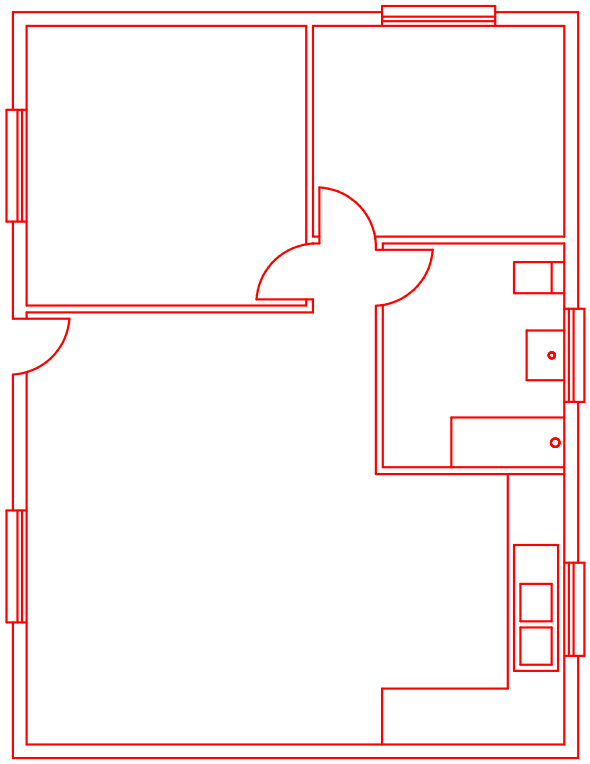
CENTRE NUMBER:								

EXAMINATION NUMBER:													

ANSWER SHEET 3.4



Municipal connection

Line type	1	
Connection angle	1	
Pipe material/gradient	3	
Rodding eye	1	
Gully	1	
Vent pipe	1	
Manhole	1	
Inspection eye	2	
Hand washbasin	1	
Water closet	1	
Sink	1	
Bath	1	
TOTAL	**15**	

(15)

CENTRE NUMBER:								

EXAMINATION NUMBER:													

ANSWER SHEET 4.1

4.1.1

A	B	C	D
			Total area of wall (3)

4.1.2

			Area of Window 1 (3)

4.1.3

			Area of Door 1 (3)

4.1.4

			Total area of wall, excluding the window and door (3)

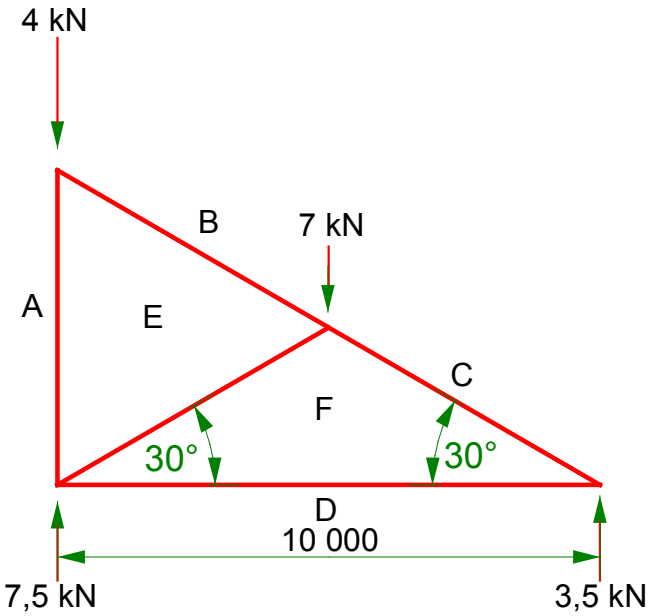
4.1.5

			Total number of bricks, including 5% for wastage (3)

CENTRE NUMBER:								

EXAMINATION NUMBER:													

ANSWER SHEET 5.2



a

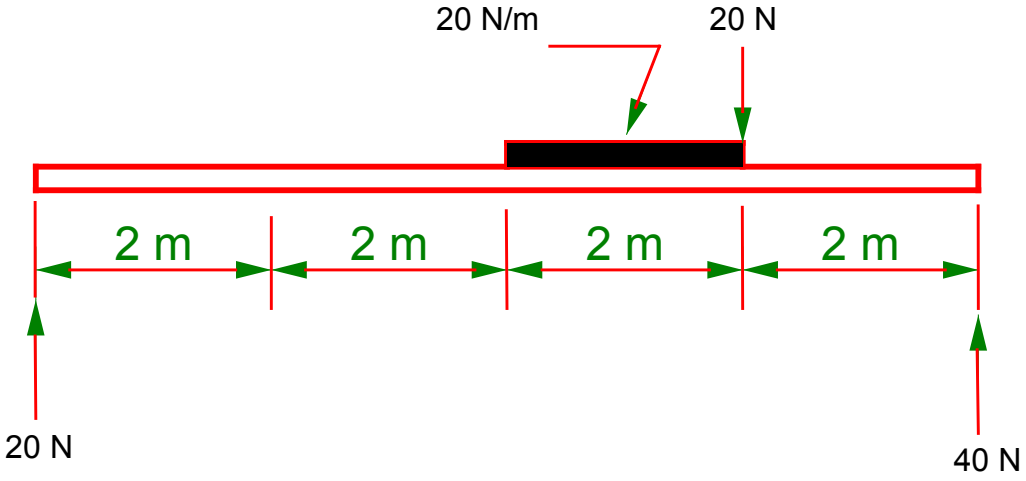
MEMBER	NATURE	MAGNITUDE OF FORCE
AE		
BE	---------	---------
CF	Strut	
DF		
EF		7 kN

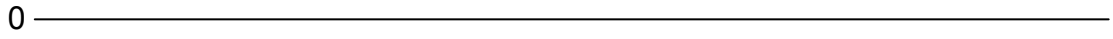
Tolerance of 1 N to either side

CENTRE NUMBER:								

EXAMINATION NUMBER:													

ANSWER SHEET 5.3





CENTRE NUMBER:								

EXAMINATION NUMBER:													

ANSWER SHEET 6.1

QUESTION	ASPECT	MARKS	
6.1.1	External walls	4	
	Internal walls	3	
6.1.2	Windows	4	
	Doors	4	
6.1.3	Built-in cupboard	1	
	Water closet	1	
	Shower	1	
	Washbasin	1	
	Sink	1	
6.1.4	Hipped roof	5	
6.1.5	Dimension	1	
6.1.6	Title	1	
	Scale	1	
	Accuracy	1	
	Neatness	1	
	TOTAL	**30**	

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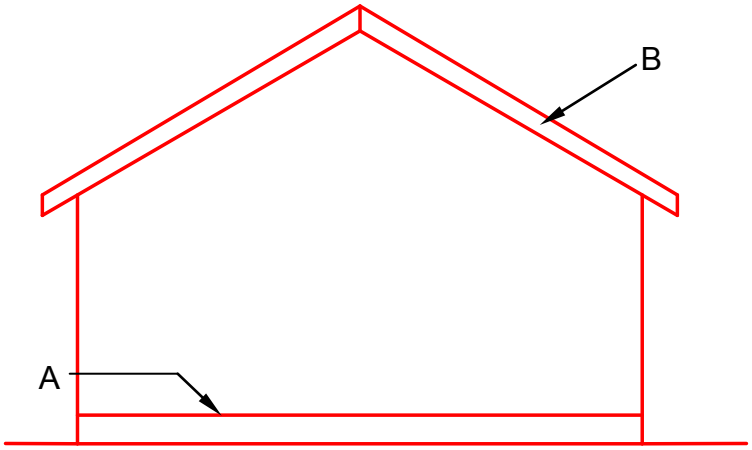
CENTRE NUMBER:								

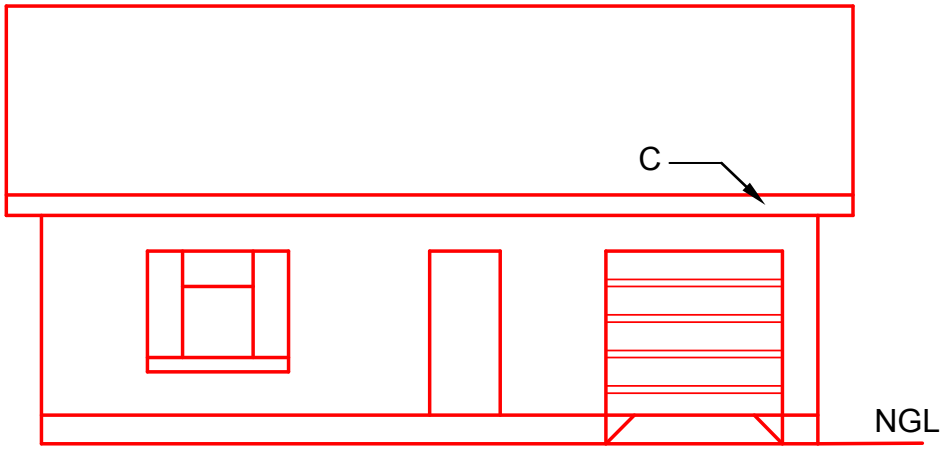
EXAMINATION NUMBER:													

ANSWER SHEET 6.2

ROOF PITCH 30°



WEST ELEVATION



SOUTH ELEVATION

SCALE 1 : 100

	QUESTIONS	ANSWERS	MARKS
6.2.1	What type of roof is on the building?		1
6.2.2	What is the slope of the roof?		1
6.2.3	What is indicated by **A** on the drawing?		1
6.2.4	What is indicated by **B** on the drawing?		1
6.2.5	Recommend a suitable finishing for the wall of the building.		2
6.2.6	What is indicated by **C** on the building?		1
6.2.7	What does the abbreviation *NGL* stand for?		1
6.2.8	Use a pencil and draw, in proportion, the position of the ridge capping on the SOUTH ELEVATION.		2
		TOTAL	**10**

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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
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	$\frac{\pi d^2}{4}$		
Semicircle	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

$$X = \frac{\sum Ax}{\sum A} \quad \textbf{OR} \quad Y = \frac{\sum Ay}{\sum A}$$

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