



# basic education

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

## **NATIONAL SENIOR CERTIFICATE**

**GRADE 12**

**CIVIL TECHNOLOGY**

**NOVEMBER 2011**

**MARKS: 200**

**TIME: 3 hours**

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

**REQUIREMENTS:**

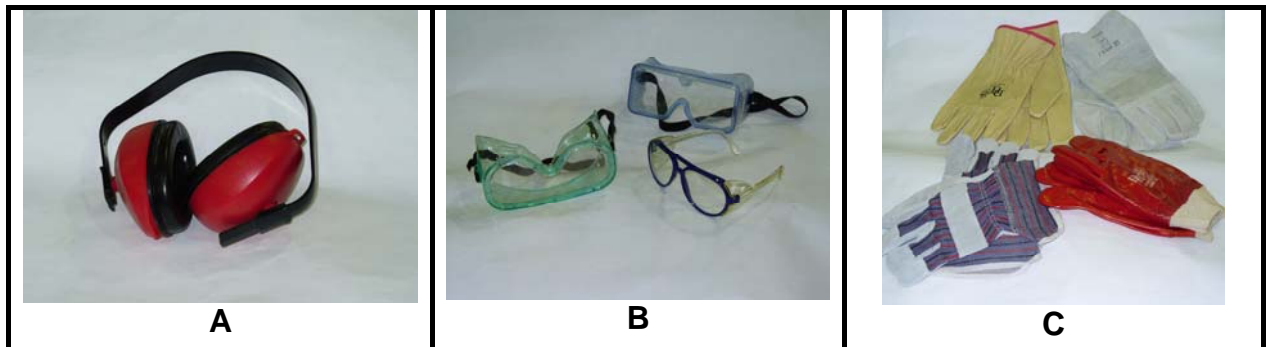
1. Drawing instruments
2. A non-programmable pocket calculator
3. ANSWER BOOK

**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. 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 2.1, 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 The pictures below are those of safety equipment worn on a building site.



1.1.1 Identify the items of equipment illustrated in **A**, **B** and **C**. (3)

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

1.2 Explain how you will stop severe external bleeding from a limb. (2)

1.3 Choose a description from COLUMN B that matches a term in COLUMN A. Write only the letter (A–L) next to the question number (1.3.1–1.3.10) in your ANSWER BOOK, for example 1.3.11 M.

COLUMN A		COLUMN B	
3.1	Sustainability	A	keeps concrete moist after casting
3.2	Pre-cast concrete	B	used to determine the compressive (crushing) strength of concrete
3.3	Slump test	C	a precision measuring instrument used to measure height and distance
3.4	PVC	D	mixture of iron, chrome, nickel and manganese
3.5	Cube test	E	an aid used with a dumpy level
3.6	In situ concrete	F	conduit pipes is an example of this material
3.7	Dumpy level	G	used to determine the workability of fresh concrete
3.8	Telescopic staff	H	removal of air bubbles from concrete
3.9	Hydration	I	concrete cast elsewhere and placed in position
3.10	Compaction	J	a chemical reaction between water and cement
		K	preserving material in its original state
		L	fresh concrete cast in place

(10 x 1) (10)

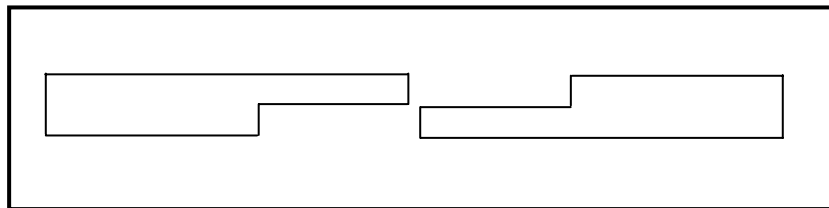
1.4 With the aid of drawing instruments, make a neat sketch of a flat gauged arch in a face-brick wall showing the following details:

- Bricks for flat gauged arch in header course
- Two courses in stretcher bond above the header course
- All surrounding brickwork in stretcher bond. Show only two courses of brickwork below the header course.
- Soffit board to support the header course
- Props to hold the soffit board in position
- A strut between the props to prevent the props from collapsing

Show ANY TWO labels on your drawing. (10)

1.5 You are required to build a gauged arch. Explain ONE method that is used to obtain the shaped bricks (voussoirs) for the arch. (1)

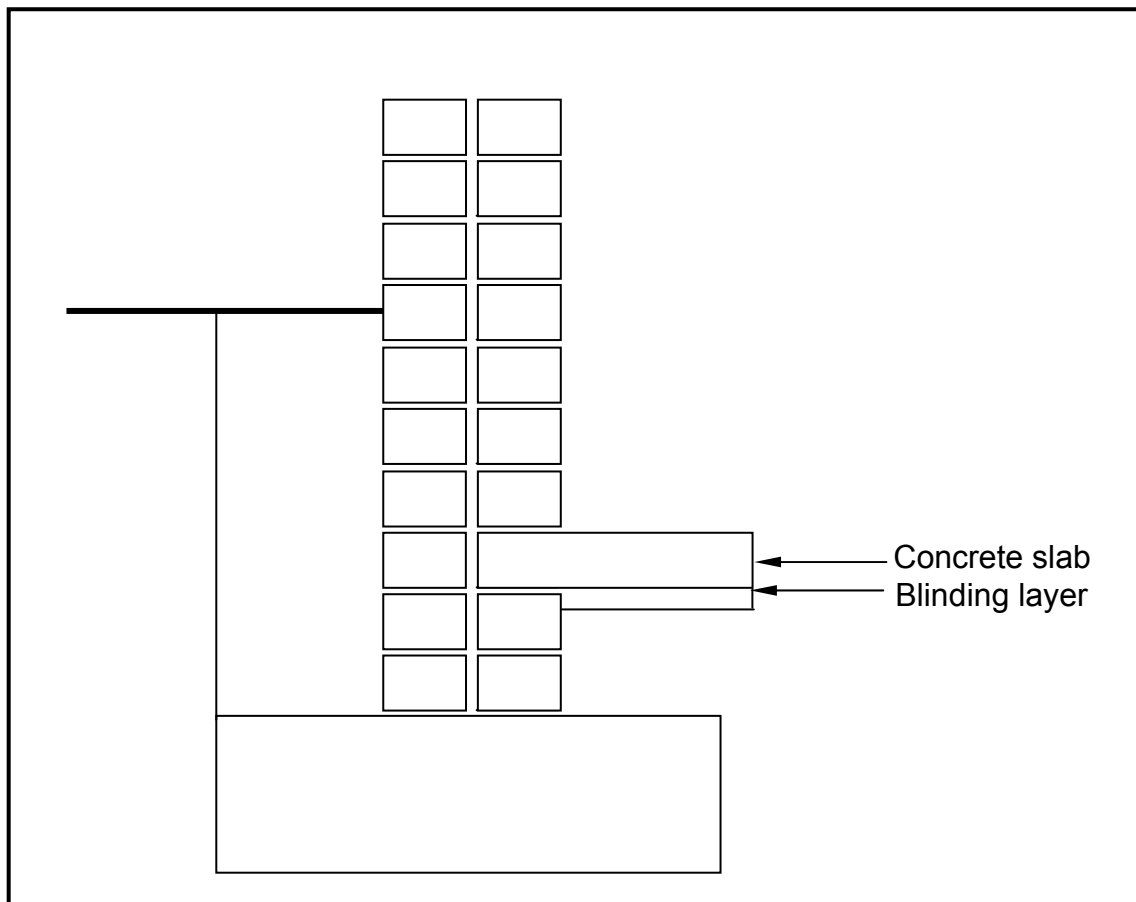
1.6 A wall plate needs to be extended along its length. The joint below is used for this purpose. Identify the joint.



(1)  
**[30]**

**QUESTION 2: ADVANCED CONSTRUCTION PROCESSES**

- 2.1 FIGURE 2.1 illustrates an incomplete sketch of a basement wall. Answer the questions that follow on the drawing on ANSWER SHEET 2.1.

**FIGURE 2.1**

- 2.1.1 Draw and indicate the correct position of the damp-proof membrane sheet. (3)
- 2.1.2 Draw the screed coat (screed) and indicate the correct drawing symbol. (1)
- 2.1.3 Draw the plaster to the internal part of the wall of the building. (1)
- 2.1.4 Draw in the symbol for earth filling below ground level in the correct place. (1)
- 2.1.5 Indicate the abbreviation for the natural ground level in the correct place. (1)
- 2.1.6 Draw in the symbol for concrete in the foundation and concrete slab. (2)
- 2.1.7 Draw in the symbol for hardcore filling under the blinding layer. (1)
- 2.1.8 Indicate the wall thickness on the drawing. (1)

2.2 Illustrate, with freehand sketches, the difference between a batten, as used for concrete roof tiles, and a purlin, as used for corrugated iron sheet roof cover. Show the measurements on your drawings. (6)

2.3 Compare dry wall construction with brick wall construction. Redraw the table below in your ANSWER BOOK and tabulate your answers. (6)

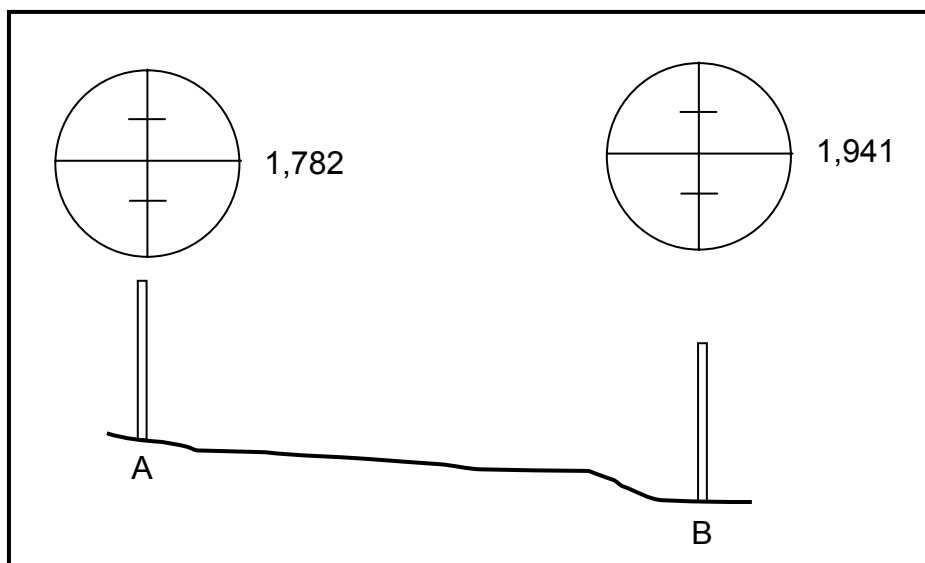
	DRY WALL CONSTRUCTION	BRICK WALL CONSTRUCTION
1		
2		
3		

2.4 Piling is used for foundations under special circumstances.

2.4.1 Name TWO types of piling. (2)

2.4.2 Explain TWO circumstances that will require the use of piles. (2)

2.5 FIGURE 2.5 shows TWO readings as seen through the eye piece of a dumpy level. Use these readings and calculate the difference in height between point A and point B. (3)



**FIGURE 2.5**

2.6 Explain what the following refer to with regard to the dumpy level, when reading in a collimation table: (3)

2.6.1 BS (1)

2.6.2 IS (1)

2.6.3 FS (1)

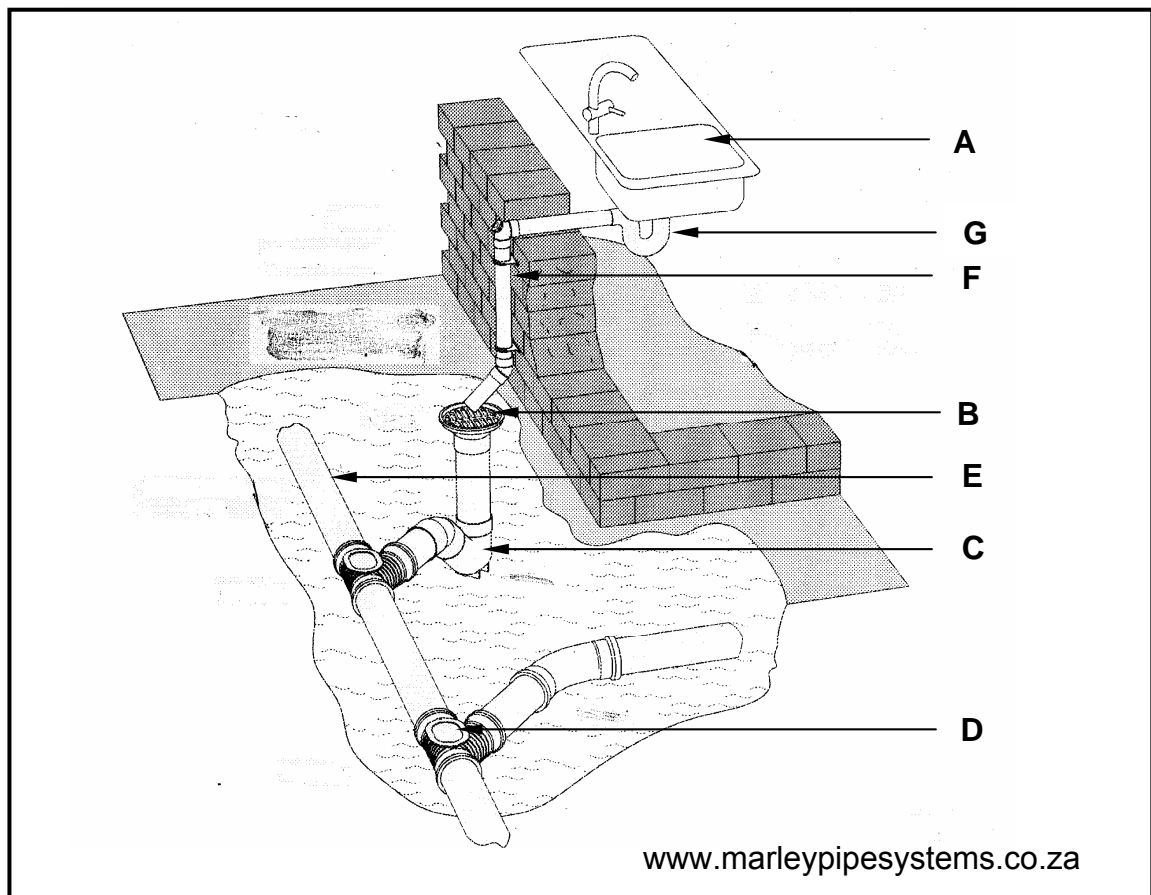
2.7 Discuss the factors that must be considered after ready-mixed concrete has been ordered to ensure that the placing of the concrete is carried out efficiently and timeously. (3)

2.8 Name TWO types of scaffolds that can be used on building sites and describe ONE place where you will use each of these types of scaffolds respectively. (4)

**[40]**

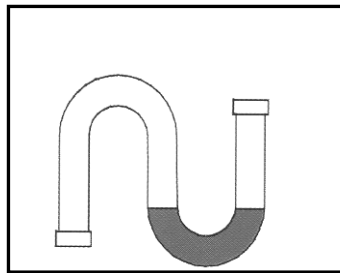
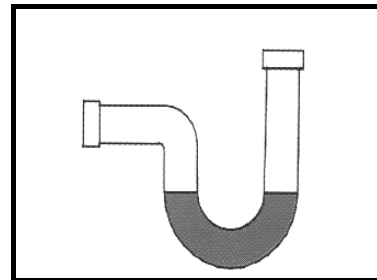
**QUESTION 3: CIVIL SERVICES**

- 3.1 FIGURE 3.1 below shows the sewerage system of a part of a house. Analyse FIGURE 3.1 and answer the questions that follow.

**FIGURE 3.1**

- 3.1.1 Write down **A–D** in your ANSWER BOOK and give the correct name of the part next to the corresponding letter. (4)
- 3.1.2 What is the diameter of pipe **E** if it is an unplasticised polyvinyl chloride (uPVC) pipe? (1)
- 3.1.3 What is the diameter of pipe **F** if it is an unplasticised polyvinyl chloride (uPVC) pipe? (1)
- 3.1.4 Explain the purpose of **G**. (1)
- 3.1.5 What is the pipe labelled **F** called? (1)
- 3.1.6 What is pipe **E** called in the sewerage system? (1)
- 3.1.7 What should the gradient of pipe **E** be for a residential dwelling? (1)
- 3.2 Explain, in your own words, the working of a septic tank. (7)

- 3.3 Describe TWO advantages of hydro-electricity. (2)
- 3.4 Describe ONE advantage of desalinating sea water. (1)
- 3.5 Describe THREE advantages of using gas water heaters. (3)
- 3.6 Explain the following abbreviations that are used on building drawing plans:
- 3.6.1 IE (1)
- 3.6.2 RE (1)
- 3.7 Give the abbreviations for the following fitments used in a building:
- 3.7.3 Water closet (1)
- 3.7.4 Bath (1)
- 3.7.5 Shower (1)
- 3.8 Identify the water traps illustrated in FIGURE 3.8.1 and FIGURE 3.8.2 below.

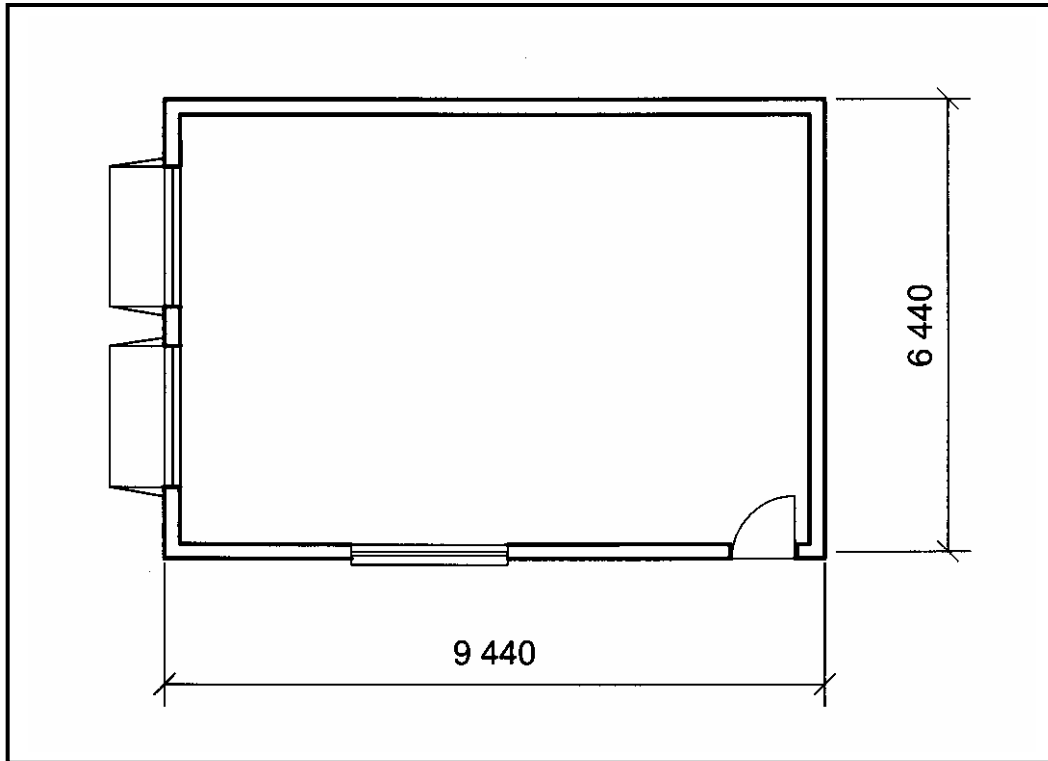
**FIGURE 3.8.1****FIGURE 3.8.2**

(2)  
[30]



**QUESTION 4: MATERIALS AND QUANTITIES**

4.1 FIGURE 4.1 below shows the floor plan of a double garage. The walls are 220 mm thick. Use ANSWER SHEET 4.1 to answer the questions that follow.



**FIGURE 4.1**

- 4.1.1 Calculate the inside length and width of the garage. (2)
- 4.1.2 Calculate the total area of the inside of the garage (excluding the walls). Round off your answer to TWO decimal places. (3)
- 4.1.3 Calculate the area of ONE ceiling board if the ceiling board measures 3 000 mm x 1 200 mm. Round off your answer to TWO decimal places. (2)
- 4.1.4 Calculate the number of ceiling boards needed for the garage. (2)
- 4.1.5 Calculate the total length of cornice required for the garage. Round off your answer to TWO decimal places. (3)

4.2 Compare TWO properties of lead with TWO properties of mild steel. Redraw the table below in your ANSWER BOOK and tabulate your answers.

	LEAD	MILD STEEL
1		
2		

(4)

4.3 FIGURE 4.3 shows a drawing of a wall-mounted cabinet made out of 16 mm thick melamine chipboard, with a 3 mm thick masonite (hardboard) back. Butt joints are used in the construction of the cabinet.

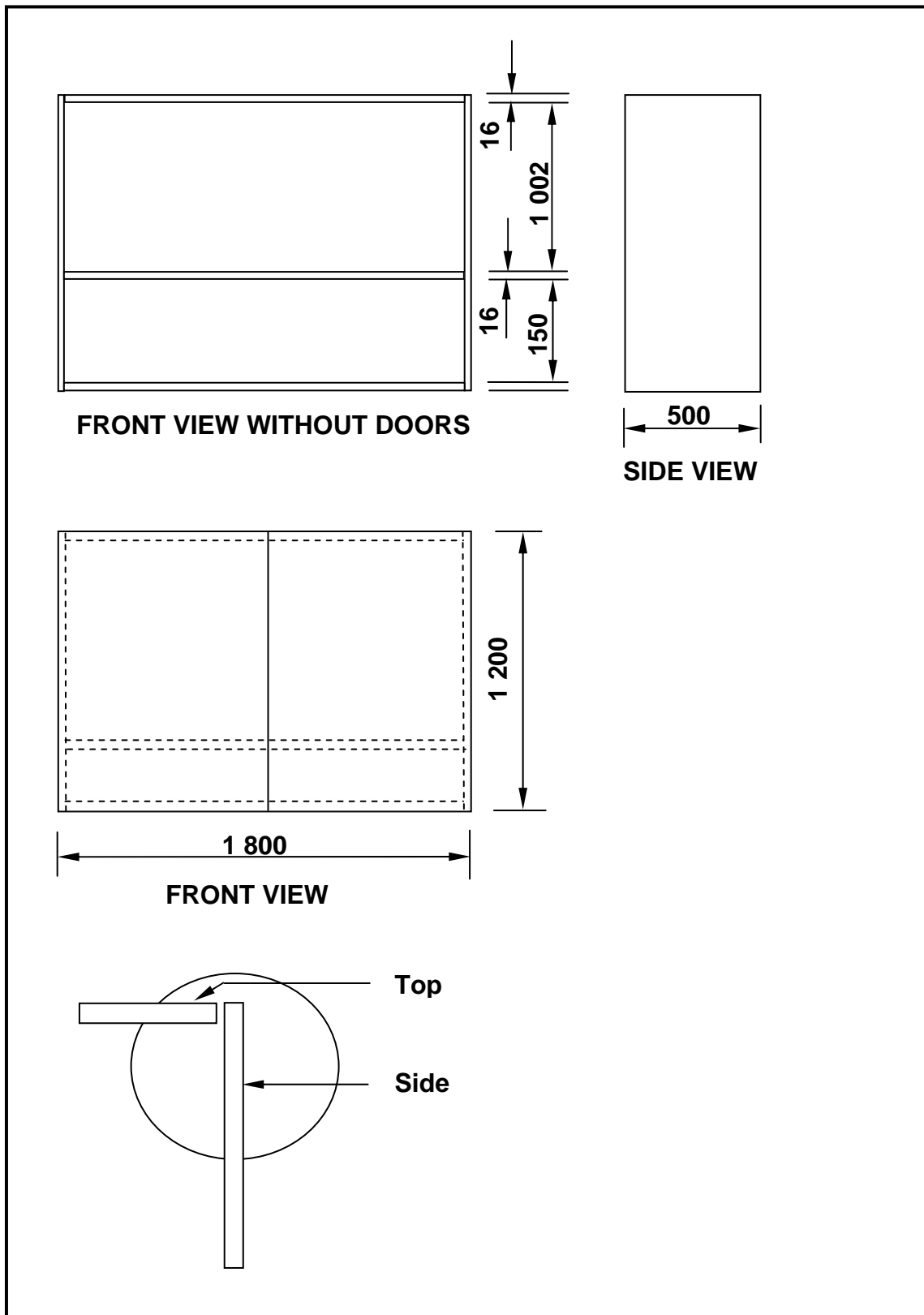


FIGURE 4.3

Use the following specifications:

- One shelf
- Two doors
- The external measurements of the cabinet are:
  - Height: 1 200 mm
  - Width: 1 800 mm
  - Depth: 500 mm
  - Thickness of melamine chipboard: 16 mm

Analyse the drawing and calculate the required information to complete the cutting list shown below. Do NOT redraw the table but write down 4.3.1–4.3.6 in your ANSWER BOOK and next to it the correct size of each part as indicated in the table.

DESCRIPTION	NUMBER REQUIRED	LENGTH	WIDTH	THICKNESS
Sides	2	4.3.1	500 mm	16 mm
Top	1	4.3.2	500 mm	16 mm
Bottom	1	4.3.3	500 mm	16 mm
Shelf	1	4.3.4	500 mm	16 mm
Doors	2	4.3.5	4.3.6	16 mm

(6)

4.4 Name TWO ways or methods that can be used to prevent mild steel sections from deteriorating. (2)

4.5 Name ONE joining agent that can be used to fix the following materials in place when finishing off a room:

4.5.1 Cornice (1)

4.5.2 Skirting (1)

4.5.3 Quadrant onto a skirting (quarter round mould) (1)

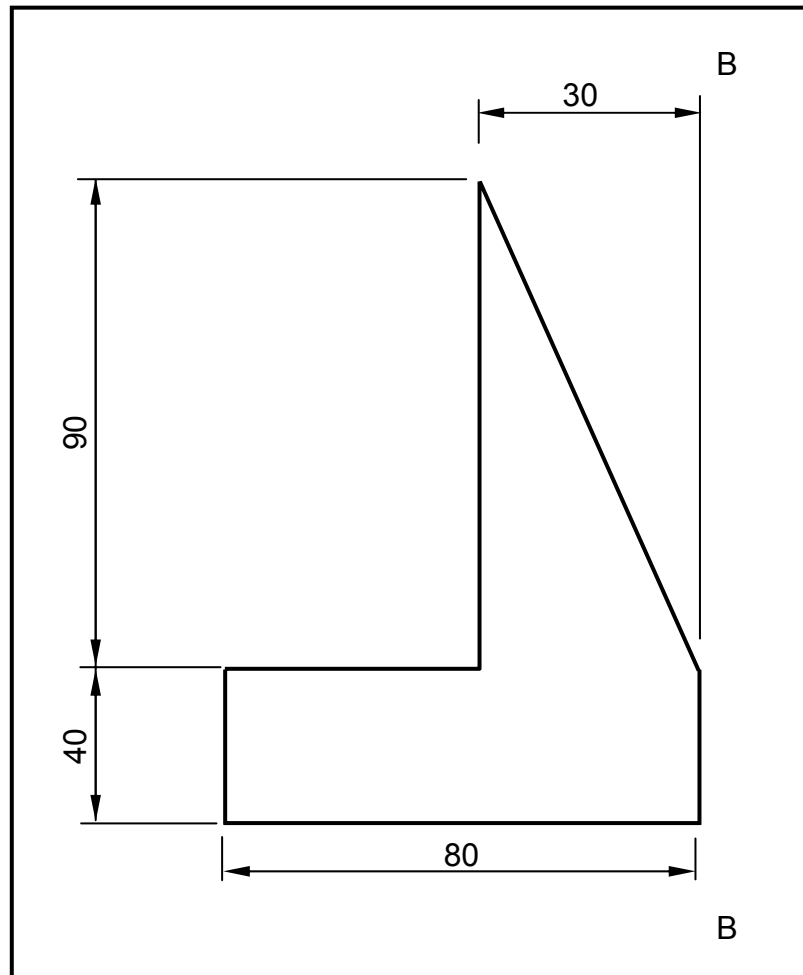
4.5.4 Ceiling board to branderings (ceiling batten) (1)

4.6 Give TWO reasons why it is necessary to treat timber with preservatives. (2)

**[30]**

**QUESTION 5: APPLIED MECHANICS**

- 5.1 FIGURE 5.1 shows a figure of a lamina. All measurements are in millimetres. Refer to the FORMULA SHEET when answering this question.

**FIGURE 5.1**

- 5.1.1 Write down the area of the rectangle. (1)
- 5.1.2 Write down the area of the triangle. (1)
- 5.1.3 Calculate the position of the centroid from B-B. Round off your answer to TWO decimal places. (8)

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

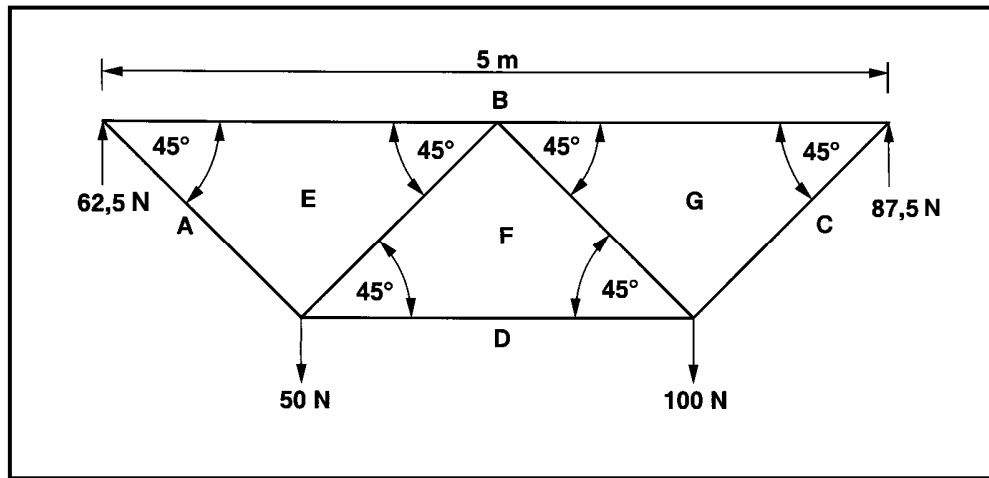


FIGURE 5.2

- 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 BE and CG on the space diagram on ANSWER SHEET 5.2. (1)
- 5.2.3 Use the information from the space and vector diagrams and complete the table on ANSWER SHEET 5.2. (4)

5.3 FIGURE 5.3 shows a beam with THREE point loads and ONE uniformly distributed load. Calculate the magnitude of the reaction force at RL by taking moments about RR.

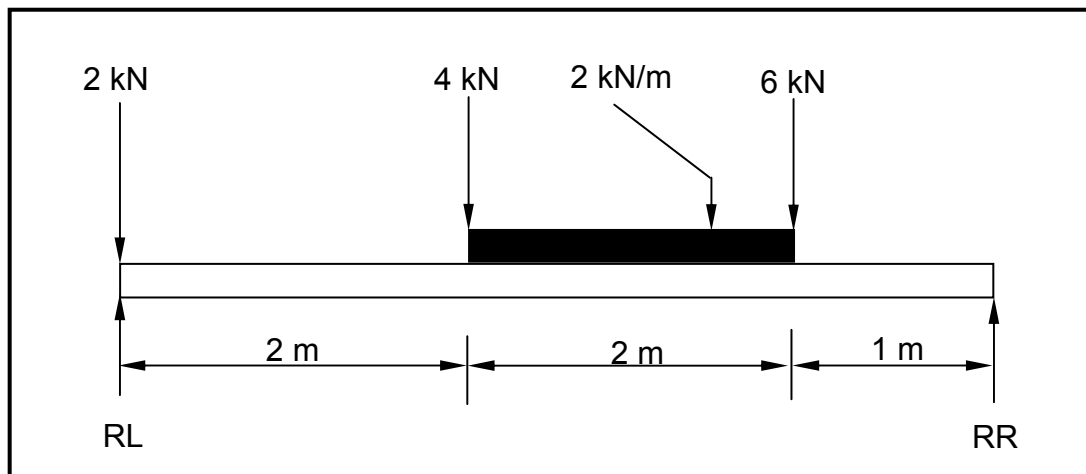
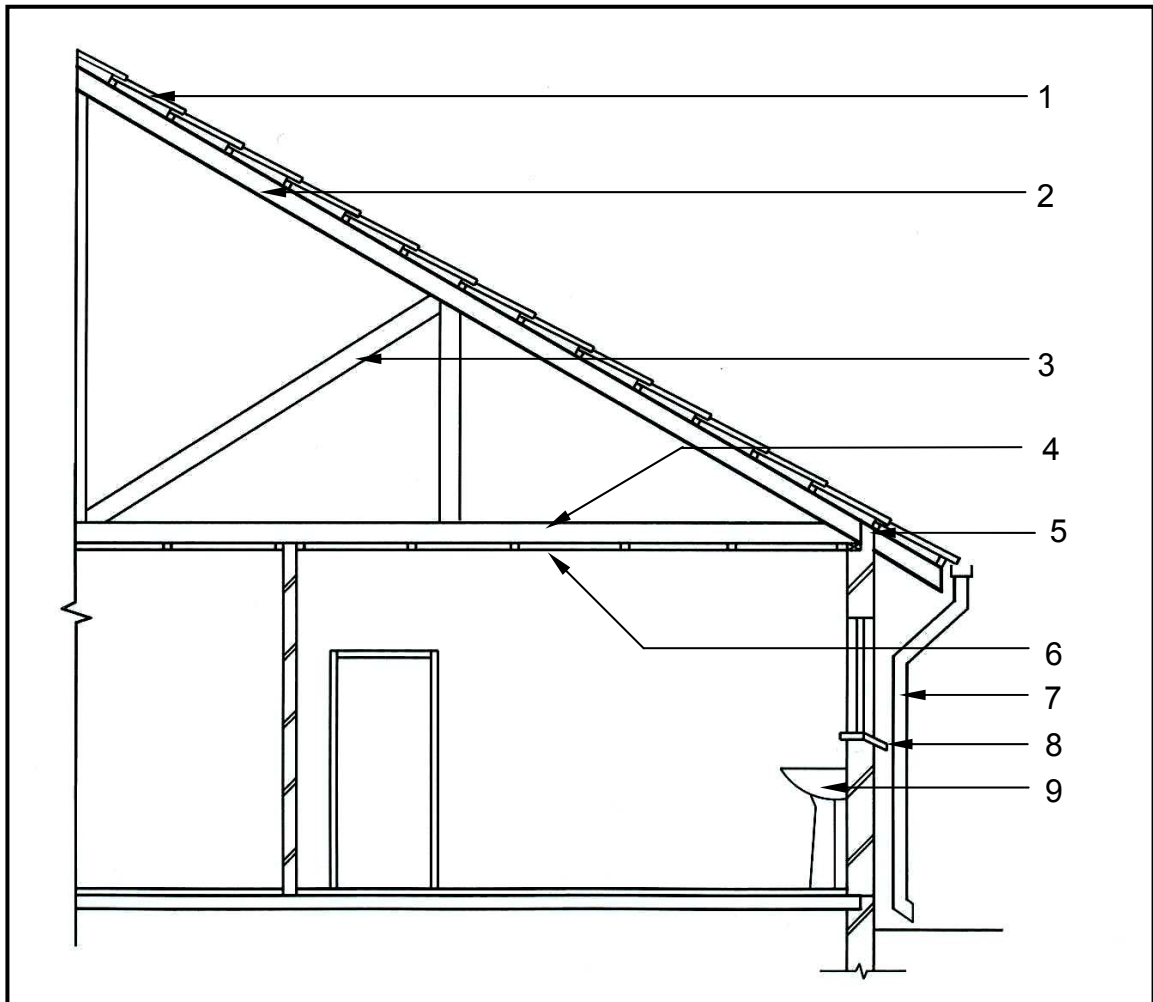


FIGURE 5.3

(6)  
[30]

**QUESTION 6: GRAPHIC COMMUNICATION**

6.1 FIGURE 6.1 illustrates an incomplete sectional view of a part of a building. 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 WEST ELEVATION of the building. Use the specifications given below as well as the window schedule shown in FIGURE 6.3.

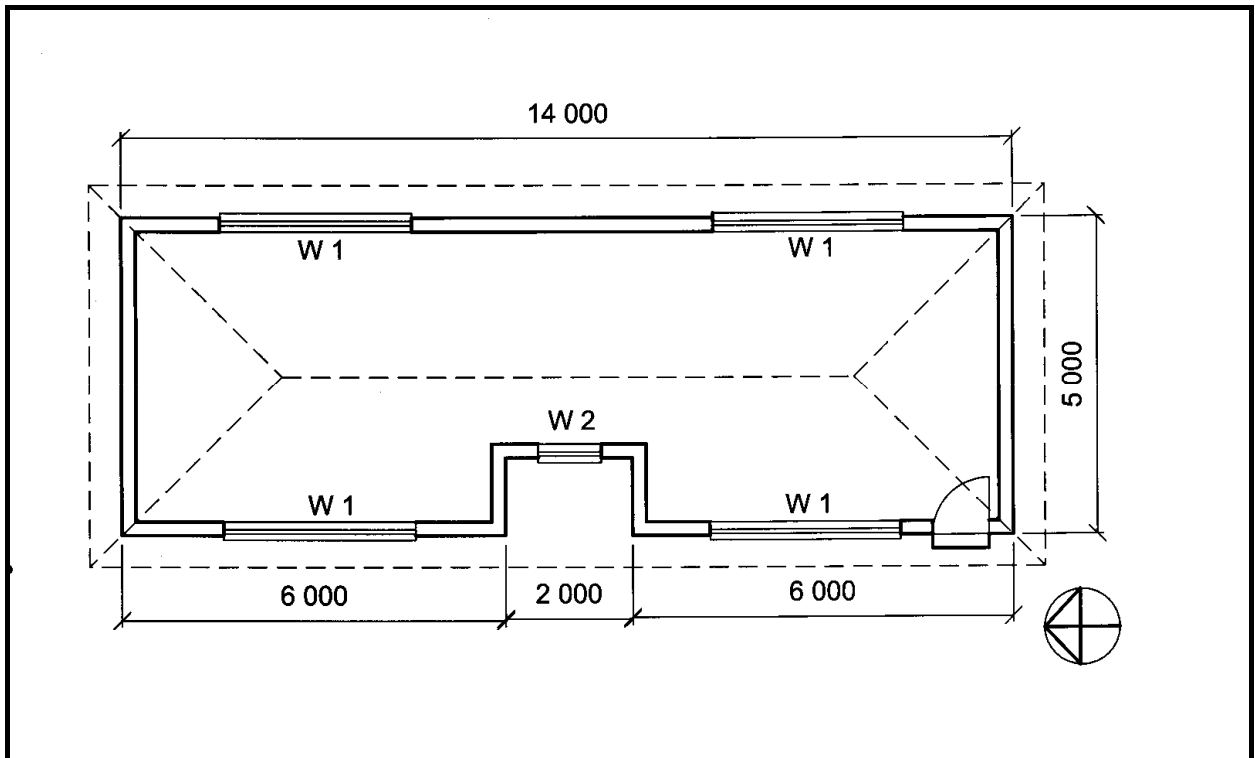


FIGURE 6.2

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.
- Rainwater pipes are 75 mm in diameter and 100 mm square gutters are used.
- The height between the top of the floor slab and the underside of the wall plate is 2 700 mm.
- The height between the natural ground level and the top of the floor slab is 300 mm.
- The eaves overhang is 500 mm.
- The door step is 150 mm high.
- The building has a hipped roof with a pitch of 30°. (21)

6.2.2 Show the following on your drawing:

The method of determining the roof height. (1)

6.2.3 Print the following labels on your drawing:

- Finished floor level (FFL) (1)
- Title (1)
- Scale (1)

<b>WINDOW SCHEDULE</b>			
<b>WINDOW 1(W 1)</b>		<b>WINDOW 2 (W 2)</b>	
<b>WIDTH</b>	<b>HEIGHT</b>	<b>WIDTH</b>	<b>HEIGHT</b>
<b>3 000</b>	<b>1 500</b>	<b>1 000</b>	<b>1 500</b>

**FIGURE 6.3**

**[40]**

**TOTAL: 200**





**CENTRE NUMBER:**

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**EXAMINATION NUMBER:**

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**QUESTION 4.1**

**ANSWER SHEET 4.1**

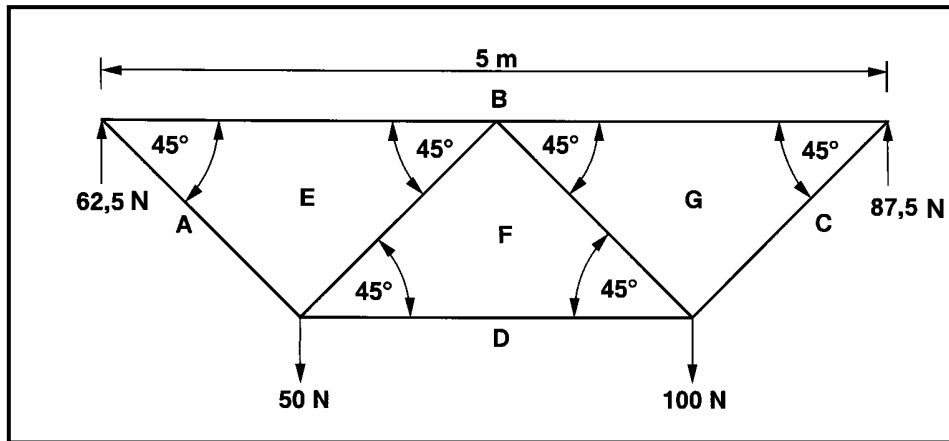
A	B	C	D
			Inside length of garage
			=
			=
			=
			Inside width of garage
			=
			=
			=
1/			Inside area of garage
1/			Area of one ceiling board
			Total number of ceiling boards required
			=
			=
			Length of cornice required for the garage
2/			Long sides
2/			Short sides
			Total length required
			=
			=

CENTRE NUMBER:

EXAMINATION NUMBER:

**QUESTION 5.2**

**ANSWER SHEET 5.2**



**Space diagram**

**QUESTION 5.2.1**

**Force diagram**

MEMBER	NATURE	MAGNITUDE
AE	Tie	
BE		62 N
BG	Strut	
CG		124 N

(1)

(9)

(4)

<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>
1	Identify the type of roof covering (labelled 1)		1
2	What type of material is the roof covering made of?		1
3	Identify number 2.		1
4	Identify number 3.		1
5	Identify number 4.		1
6	Identify number 5.		1
7	What is wrong with the heights of the window and door?		1
8	Identify number 6.		1
9	Study the internal wall on the concrete slab and identify ONE error.		1
10	What is the width of the internal wall if it is a half brick wall?		1
11	Name ONE material that can be used to make this component indicated by number 7.		1
12	Identify number 8.		1
13	Identify number 9.		1
14	Draw a freehand symbol for a bath.		2

(15)

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

**ANSWER SHEET 6.2**

(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
$\pi$	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 x b	$\frac{l}{2}$	$\frac{b}{2}$
Right-angled triangle	$\frac{1}{2}$ x base x height	$\frac{1}{2}b \times h$	$\frac{b}{3}$	$\frac{h}{3}$
Equilateral triangle/ Pyramid	$\frac{1}{2}$ x base x height	$\frac{1}{2}b \times h$	$\frac{b}{2}$	$\frac{h}{3}$
Circle	$\pi$ x radius x radius	$\pi r^2$	Centroid is in the centre	
Circle	$\pi$ x diameter x diameter divided by 4	$\frac{\pi d^2}{4}$		
Semi-circle	$\pi$ x radius x radius divided by 2	$\frac{\pi r^2}{2}$		

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

OR

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