



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

CIVIL TECHNOLOGY

NOVEMBER 2013

MARKS: 200

TIME: 3 hours

This question paper consists of 14 pages, 9 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 the answer to EACH question on a NEW page.
5. Do NOT write in the margins 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 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 own discretion where dimensions and/or details have been omitted.
12. Answer QUESTIONS 1.3, 2.5, 2.6, 3.2, 4.2, 5.2.1, 5.4.1, 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 an item in COLUMN A. Write only the letter (A–L) next to the question number (1.1.1–1.1.10) in the ANSWER BOOK, for example 1.1.11 M.

| COLUMN A | | COLUMN B |
|----------|-----------------------|--|
| 1.1.1 | Brick force | A a restriction that prevents you from building in a specific area |
| 1.1.2 | Servitude | B a horizontal member of a roof truss |
| 1.1.3 | Thatching | C a vertical member of a roof truss |
| 1.1.4 | Tie beam | D a level platform on which a scaffold is erected |
| 1.1.5 | Roof underlay | E a tool that can be used to cut bricks |
| 1.1.6 | Sole plate/Base plate | F an inclined member of a roof truss |
| 1.1.7 | King post | G used to transfer levels between two points |
| 1.1.8 | Corrosion | H the sustainability of metals |
| 1.1.9 | Angle grinder | I waterproof membrane |
| 1.1.10 | Rafter | J reinforcement found between courses of brickwork |
| | | K a roof covering made of grass |
| | | L a chemical process that brings about decomposition in ferrous metals |

(10)

- 1.2 Cement has been delivered to your site and you are required to move it from the truck to the shed. Name THREE personal safety items you will wear while carrying the cement from the truck to the shed.

(3)

- 1.3 The sketch on ANSWER SHEET 1.3 (attached) shows a plan course of a wall built in English bond.
- 1.3.1 Use ANSWER SHEET 1.3 to project and draw, from the given view, the consecutive course of the wall in good proportion. Show the following on the drawing:
- Headers (3)
 - Queen closers (3)
- NOTE:** Proportion and line work will count two marks. (2)
- 1.3.2 Print a title for the drawing. (1)
- 1.3.3 Indicate the following labels on your drawing:
- Header (1)
 - Queen closer (1)
- 1.4 Make a neat freehand sketch of a vertical sectional view of two planks to show an assembled tongue and groove joint for a floor. Show the grain of the two tongue and groove planks. (3)
- 1.5 Name TWO items (fixing agents) that can be used to mount a cabinet against a wall. (2)
- 1.6 Complete the following sentences by using the words in the list below. Write only the word(s) next to the question number (1.6.1–1.6.4) in the ANSWER BOOK.
- bolts and nuts; dry wall screws; panel pins; galvanising; wall ties;
clout nails; varnish; plaster primer; gang nails; bonding liquid
- The two materials that can be used to join members of roof trusses are (1.6.1) ... and (1.6.2) ... (2)
- (1.6.3) ... are used to join two skins (layers) of a cavity wall. (1)
- (1.6.4) ... are used to fix gypsum ceiling boards to brandering (ceiling battens) before the boards are skimmed. (1)
- [30]**

QUESTION 2: ADVANCED CONSTRUCTION PROCESSES

(ANSWER THIS QUESTION ON A NEW PAGE.)

2.1 Indicate whether the following statements are TRUE or FALSE. Write only 'true' or 'false' next to the question number (2.1.1–2.1.5) in the ANSWER BOOK.

2.1.1 Pile foundations are used in stable ground. (1)

2.1.2 Stirrups are found in a reinforced beam. (1)

2.1.3 Independent scaffolding is a type of scaffolding that is secured to a building. (1)

2.1.4 Strip foundations are used in unstable soil. (1)

2.1.5 Voussoirs are tapered bricks used in the construction of arches. (1)

2.2 FIGURE 2.2 below shows the installation of a rib-and-block suspended concrete floor.



FIGURE 2.2

2.2.1 When the installation shown in FIGURE 2.2 has been completed, explain the follow-up processes to complete the floor. (4)

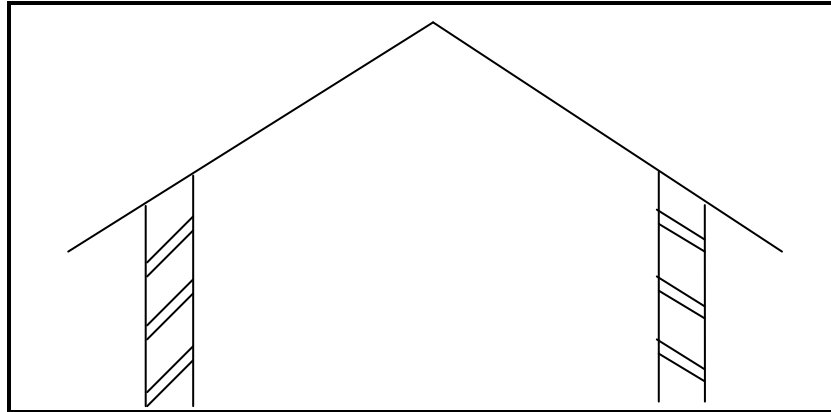
2.2.2 Recommend another construction method that can be used to construct a suspended concrete floor. (1)

2.2.3 Explain ONE advantage of the type of suspended floor shown in FIGURE 2.2 above over other methods of construction. (1)

2.2.4 Recommend a floor covering you will use to finish this floor. (1)

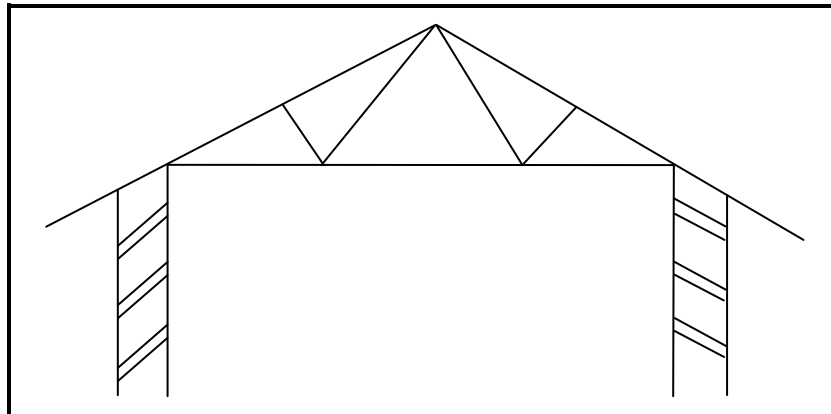
2.3 The figures below show various types of roof trusses. Identify the roof trusses illustrated below.

2.3.1



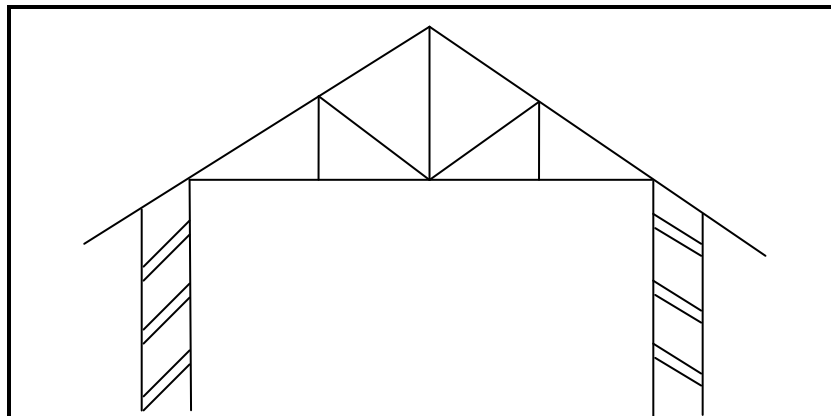
(1)

2.3.2



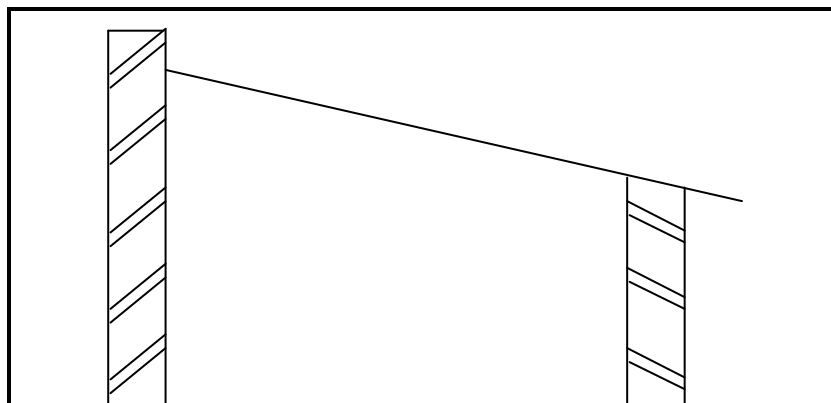
(1)

2.3.3



(1)

2.3.4



(1)

- 2.4 FIGURE 2.4 below illustrates an incomplete horizontal sectional view through a dry wall. Study the sketch and answer the questions that follow.

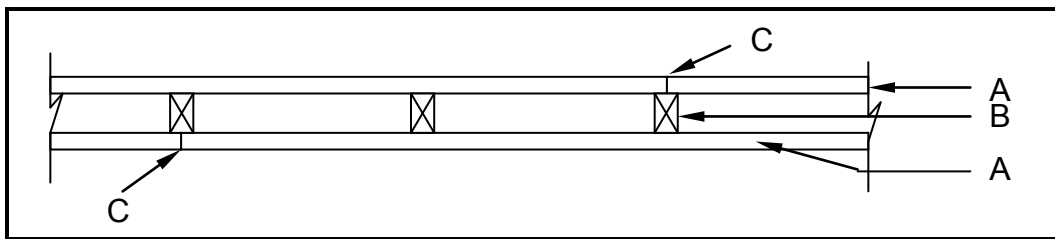


FIGURE 2.4

- 2.4.1 Name parts **A** and **B**. (2)
- 2.4.2 Recommend the material to be used for **B**. (1)
- 2.4.3 Explain why joints **C** in part **A** are staggered on either side of **B**. (1)
- 2.4.4 Recommend TWO methods to conceal the joints at **C**. (2)
- 2.5 Two square concrete columns are to be used as supports for billboards that are to be erected in front of your school. Make a horizontal sectional drawing showing the formwork of ONE of the columns. Use the following specifications and draw on ANSWER SHEET 2.5 (attached), to scale 1 : 10, the horizontal section of the formwork.
- Specifications:
- Size of the column is 500 mm x 500 mm
 - Shutter board 21 mm thick
 - Two clamps 76 mm x 50 mm
 - Two yokes 76 mm x 50 mm
 - Four wedges
 - Two 16 mm diameter (\emptyset) threaded rods with nuts
- (12)
- 2.6 FIGURE 2.6 on ANSWER SHEET 2.6 (attached) shows a dumpy level in two different positions. The incomplete level-book page (collimation table) is given.
- 2.6.1 Use the information in the table and calculate the values for **D** and **E**. (2)
- 2.6.2 Calculate the differences and show the results of your answers in the table. (4)
- [40]**

QUESTION 3: CIVIL SERVICES

(ANSWER THIS QUESTION ON A NEW PAGE.)

- 3.1 FIGURE 3A and FIGURE 3B below show different methods of generating electricity. Study the photos and answer the questions that follow.

**FIGURE 3A****FIGURE 3B**

- 3.1.1 Identify the primary source for generating electricity as shown in FIGURE 3A. (1)
- 3.1.2 Identify the primary source for generating electricity as shown in FIGURE 3B. (1)
- 3.1.3 Explain TWO advantages of generating electricity as shown in FIGURE 3A. (2)
- 3.1.4 Explain TWO disadvantages of generating electricity as shown in FIGURE 3B. (2)
- 3.2 FIGURE 3.2 on ANSWER SHEET 3.2 (attached) shows a line diagram of an L-shaped building that is to be erected on a vacant stand.
- 3.2.1 Draw the symbols for the following sanitary fittings indicated by numbers 1 to 4 on ANSWER SHEET 3.2: (4)
1. Shower
 2. Water closet
 3. Wash basin
 4. Double-bowl kitchen sink
- 3.2.2 On ANSWER SHEET 3.2, design a sewerage system and draw the sewerage plan for the building. Take into consideration all regulations and design principles of a good sewerage system. Indicate the following on your drawing: (11)
- A manhole near the connection to the conservancy tank
 - A gulley at the kitchen sink
 - A vent pipe at the water closet
 - A rodding eye at the highest point of the sewerage system and another one where there is a change in direction
 - Inspection eyes where branch and main pipes meet
 - Indicate all sewerage abbreviations where applicable

- 3.2.3 On the drawing, indicate the diameter of the pipe, the type of pipe and the slope of the main sewer line. (3)
- 3.2.4 Next to the electrical symbols (A–F) on ANSWER SHEET 3.2, write the correct names for the symbols shown. (6)

[30]**QUESTION 4: MATERIALS AND QUANTITIES**

(ANSWER THIS QUESTION ON A NEW PAGE.)

4.1 You are provided with the following equipment and material on a building site:

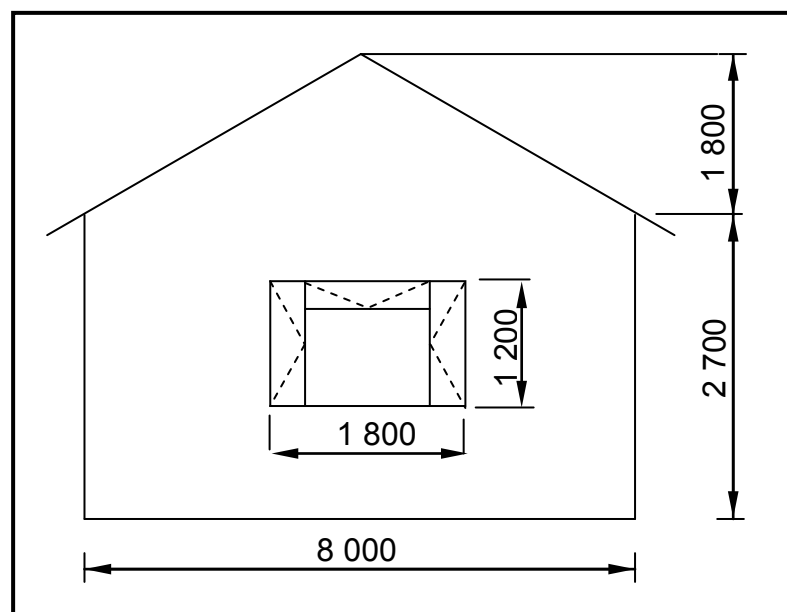
- Waterproof base
- Tamping rod
- Frustum
- Tape measure
- Fresh concrete

4.1.1 Name the test that you are expected to conduct with the equipment and material provided to you. (1)

4.1.2 Name THREE possible results of the test you conducted on the fresh concrete. (3)

4.1.3 Make neat freehand sketches of TWO possible results of the test done on the concrete. Label your drawings. (4)

4.2 FIGURE 4.2 below shows the elevation of a building with a gable wall. The wall is 220 mm thick. Use ANSWER SHEET 4.2 (attached) to calculate the following:

**FIGURE 4.2**

4.2.1 The number of bricks required to build the wall if 110 bricks are used to build one square metre of a 220 mm thick wall (15)

4.2.2 5% for breakages and cutting of bricks (2)

4.3 Explain TWO negative consequences that insufficient concrete cover can have on reinforcement in concrete structures. (2)

4.4 Explain THREE advantages of using varnish as a preservative on timber windows. (3)
[30]

QUESTION 5: APPLIED MECHANICS

(ANSWER THIS QUESTION ON A NEW PAGE.)

5.1 A beam with a length of 8 m is subjected to three point loads as shown in the space diagram in FIGURE 5.1 below.

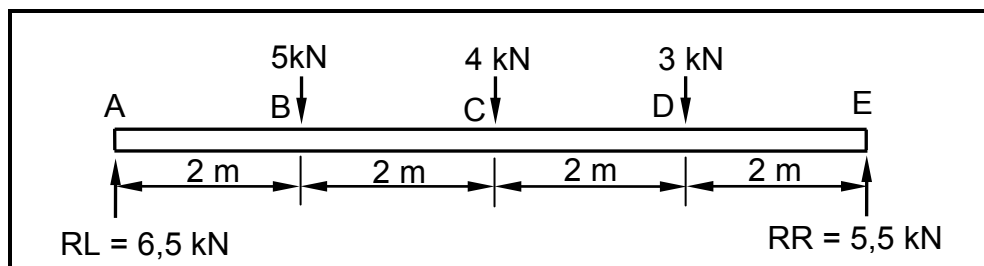


FIGURE 5.1

5.1.1 Prove, by means of calculation, that the bending moment at A (BM_a) = 0 kNm. (1)

5.1.2 Prove, by means of calculation, that the bending moment at B (BM_b) = 13 kNm. (1)

5.1.3 Prove, by means of calculation, that the bending moment at C (BM_c) = 16 kNm. (1)

5.1.4 Prove, by means of calculation, that the bending moment at D (BM_d) = 11 kNm. (1)

5.1.5 Prove, by means of calculation, that the bending moment at E (BM_e) = 0 kNm. (1)

5.1.6 Prove, by means of calculation, that the beam is in equilibrium. (1)

5.2 Use the information in QUESTION 5.1 and draw the following on ANSWER SHEET 5.2.1 (attached):

5.2.1 The space diagram of the beam to scale 10 mm = 1 m (1)

5.2.2 The bending moment diagram to scale 5 mm = 1 kNm (4)

5.3 FIGURE 5.3 below shows a lamina of a right-angled triangle with a rectangular hole in it. Calculate the position of the centroid of the lamina from A–A. Round off your answer to TWO decimals.

HINT: Use the formula on the formula sheet.

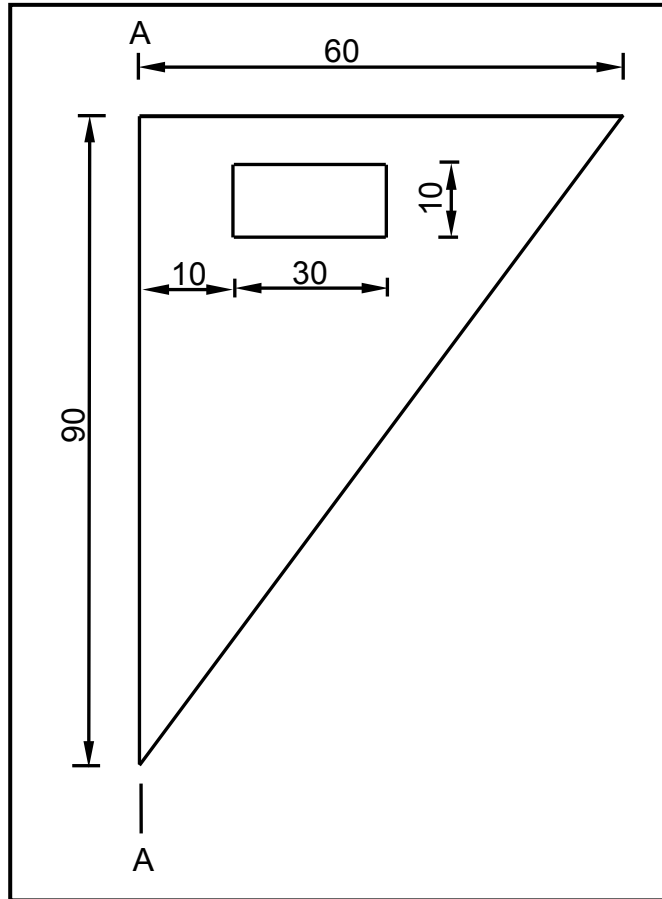


FIGURE 5.3

(8)

5.4 FIGURE 5.4 below shows the space diagram of a king-post roof truss with a single point load of 150 N and a span of 10 metres.

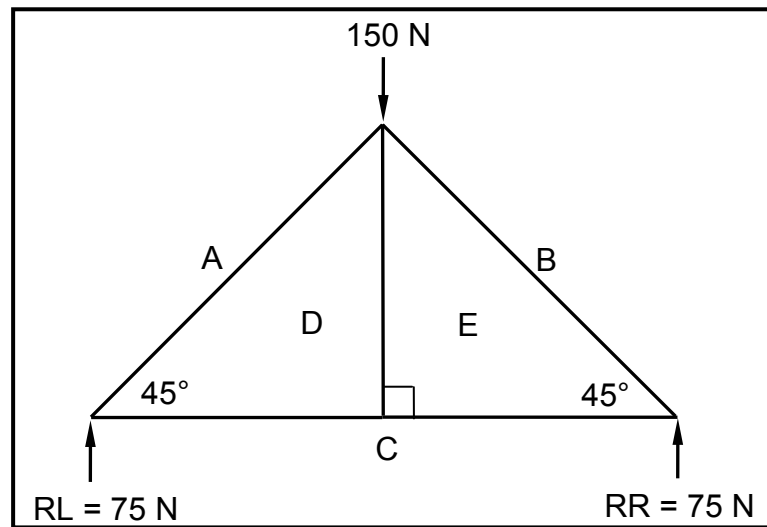


FIGURE 5.4

- 5.4.1 On ANSWER SHEET 5.4.1 (attached), develop and draw a vector diagram to determine graphically the magnitude and nature of the forces in each member (part) of the truss. Use scale 1 mm = 1 N. (5)
- 5.4.2 Deduce (Use) the information from the space and vector diagrams and complete the table on ANSWER SHEET 5.4.1. (6) [30]

QUESTION 6: GRAPHIC COMMUNICATION

6.1 FIGURE 6.1 shows a single-line diagram plan of a granny flat.

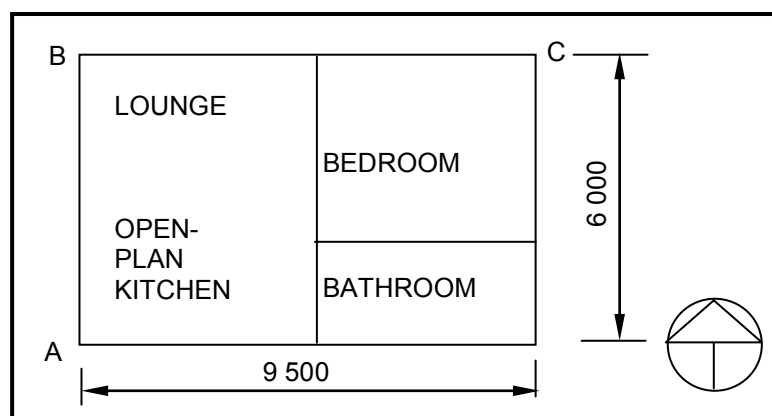


FIGURE 6.1

- 6.1.1 On ANSWER SHEET 6.1 (attached), develop and draw to scale 1 : 50 the floor plan for the granny flat. Use the specifications given below.

Specifications:

- External walls are 220 mm thick.
- Internal walls are 110 mm thick.
- All door openings are 900 mm wide.
- The internal measurements of the rooms are:
 - Open-plan kitchen and lounge: 4 950 mm x 5 560 mm
 - Bedroom: 4 000 mm x 3 450 mm
 - Bathroom: 4 000 mm x 2 000 mm

Show the following in your drawing:

ON THE NORTHERN SIDE OF THE BUILDING

- An entrance door to the lounge which is 500 mm from point **B**
- A window 1 800 mm wide is placed in the centre of the wall of the lounge
- A window 1 800 mm wide in the bedroom is placed 1 000 mm from point **C**

ON THE SOUTHERN SIDE

- An entrance door to the kitchen which is 500 mm from point **A**
- A window 1 200 mm wide is placed in the centre of the wall of the kitchen
- A window 1 200 mm wide is placed in the centre of the wall of the bathroom

IN THE BEDROOM

- A door that leads from the lounge into the bedroom
- A door that leads from the bedroom into the bathroom
- A built-in cupboard

IN THE KITCHEN

- A single-bowl kitchen sink under the window (1 000 mm x 500 mm)

IN THE BATHROOM

- A water closet
- A bath (1 800 mm x 800 mm)
- A wash basin (500 mm x 350 mm) (21)

- 6.1.2 Indicate the dimensions of the overall length and width of the building on the drawing. (2)

- 6.1.3 Print the title and scale below the drawing. (2)

- 6.2 The drawing on ANSWER SHEET 6.2 (attached) shows the south elevation of a building. Use ANSWER SHEET 6.2 and answer the questions that follow.
- 6.2.1 Complete the table to indicate the name of members **A** to **H**, and **J** to **M**. (12)
- 6.2.2 What must the minimum distance between **J** and **K** be? (1)
- 6.2.3 What will be a suitable scale for drawing this elevation? (1)
- 6.2.4 Recommend a suitable exterior finish for the wall. (1)
- TOTAL: 200**

| | | | | | | | | | |
|-----------------------|--|--|--|--|--|--|--|--|--|
| CENTRE NUMBER: | | | | | | | | | |
|-----------------------|--|--|--|--|--|--|--|--|--|

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QUESTION 1.3

ANSWER SHEET 1.3

| Assessment criteria | | LM |
|----------------------------|----------|-----------|
| Header | 1 | |
| Queen closers | 2 | |
| Proportion and line work | 2 | |
| Title | 1 | |
| Label: Header | 1 | |
| Label: Queen closer | 1 | |
| Total | 8 | |

LM = Learner's mark

| | | | | |
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| | | | | |
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QUESTION 2.5**ANSWER SHEET 2.5****FIGURE 2.5**

| Assessment criteria | | LM |
|-------------------------------|-----------|-----------|
| 16 mm Ø threaded rod with nut | 1 | |
| Yokes | 2 | |
| Clamps | 2 | |
| Wedges | 2 | |
| Labels | 2 | |
| Title | 1 | |
| Scale | 2 | |
| Total | 12 | |

LM = Learner's mark

(12)

CENTRE NUMBER:

EXAMINATION NUMBER:

QUESTION 2.6

ANSWER SHEET 2.6

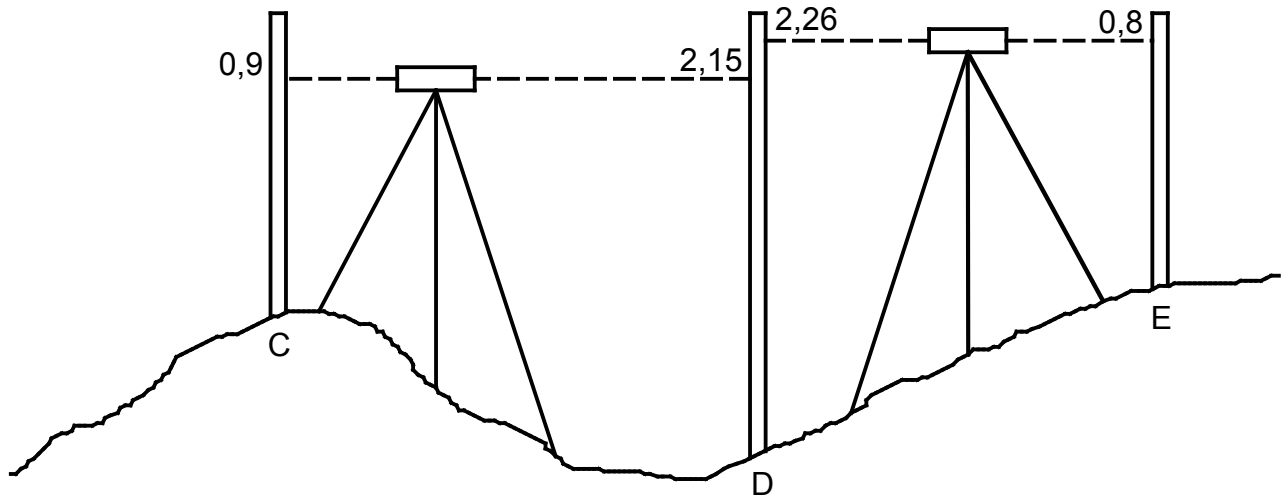


FIGURE 2.6

| BS | FS | RISE | FALL | REMARK |
|------|------|----------|----------|-------------------|
| 0,9 | | | | Peg A |
| | 2,15 | | D | Peg B |
| 2,26 | | | | Peg C |
| | 0,8 | E | | Peg D |
| | | | | TOTAL |
| | | | | DIFFERENCE |
| | | | | RESULT |

(6)

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QUESTION 3.2

ANSWER SHEET 3.2

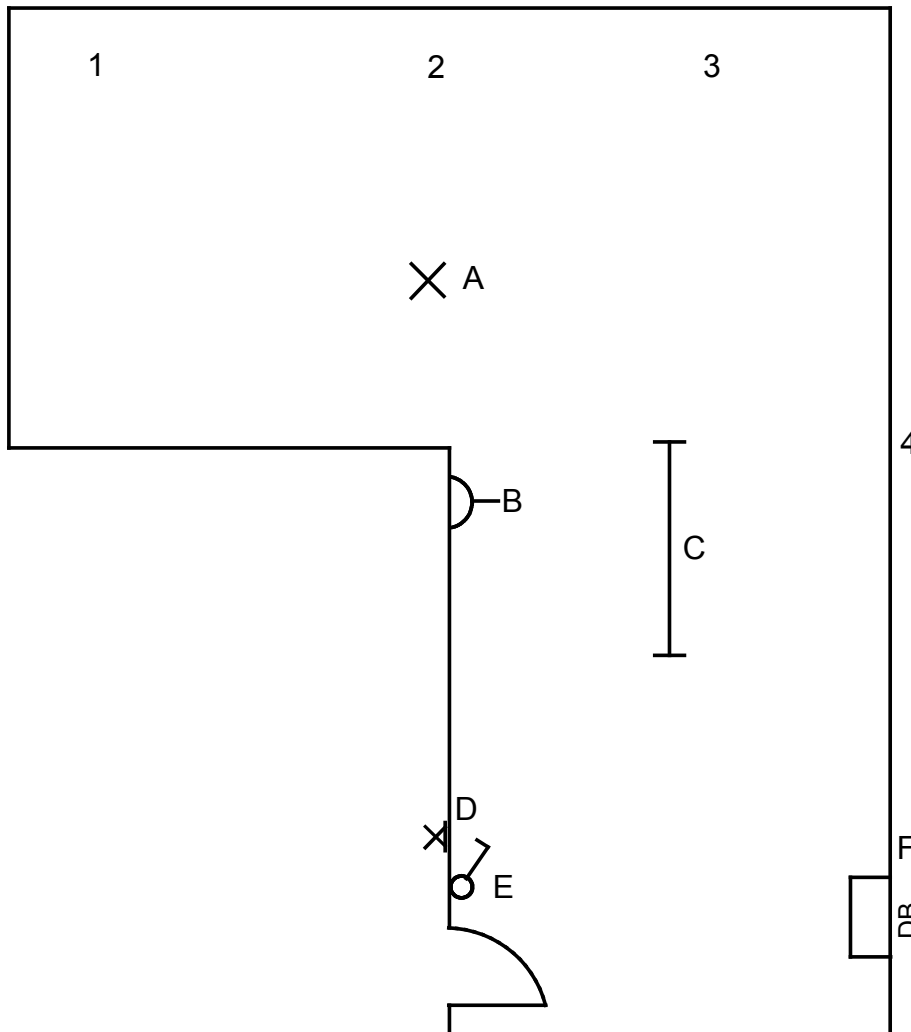


FIGURE 3.2

| | Assessment Criteria | Marks | LM |
|-------|----------------------------|--------------|-----------|
| 3.2.1 | Sanitary symbols | 4 | |
| 3.2.2 | Manhole | 1 | |
| | Gully | 1 | |
| | Vent pipe | 1 | |
| | Rodding eye | 2 | |
| | Inspection eye | 2 | |
| | Correct sewerage layout | 2 | |
| | Sanitary abbreviations | 2 | |
| 3.2.3 | Description of pipe | 3 | |
| 3.2.4 | Electrical symbols | 6 | |
| | Total | 24 | |

Connection to conservancy tank

LM = Learner's mark

CENTRE NUMBER:

| | | | | | | | | | |
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| | | | | | | | | | |
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|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|

QUESTION 4.2

ANSWER SHEET 4.2

4.2

| A | B | C | D |
|----|---|---|---|
| 1/ | | | Area of rectangular wall up to wall plate level |
| | | | |
| | | | |
| 1/ | | | Area of gable (triangular) part of wall |
| | | | |
| | | | |
| | | | Total area of wall without window opening |
| | | | |
| 1/ | | | Area of window |
| | | | |
| | | | |
| | | | |
| | | | Area of wall with window opening |
| | | | |
| | | | |
| 1/ | | | Number of bricks |
| | | | 110 bricks per m ² for a 220 mm wall |
| | | | |
| 1/ | | | 5% breakages and cutting of bricks |
| | | | |
| | | | |

(15)

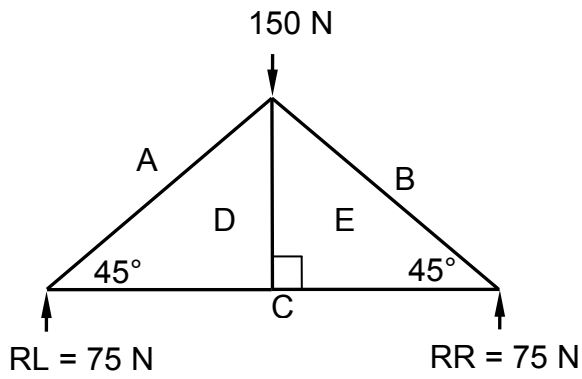
(2)

CENTRE NUMBER:

EXAMINATION NUMBER:

QUESTION 5.4.1

ANSWER SHEET 5.4.1



a

(5)

5.4.2

| MEMBER | MAGNITUDE | NATURE |
|--------|-----------|--------|
| AD | | |
| BE | 106 N | |
| CD | | Tie |
| DE | 0 | |
| EC | 75 N | |

Tolerance: 1 N on either side

(6)

CENTRE NUMBER:

EXAMINATION NUMBER:

QUESTION 6.1

ANSWER SHEET 6.1

| Aspect | Marks | LM |
|----------------------|--------------|-----------|
| Windows | 4 | |
| Doors | 4 | |
| Drawing the symbols | 4 | |
| External walls | 4 | |
| Internal walls | 2 | |
| Dimensions | 2 | |
| Title and scale | 2 | |
| Application of scale | 2 | |
| Neatness | 1 | |
| Total | 25 | |

CENTRE NUMBER:

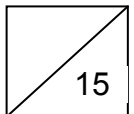
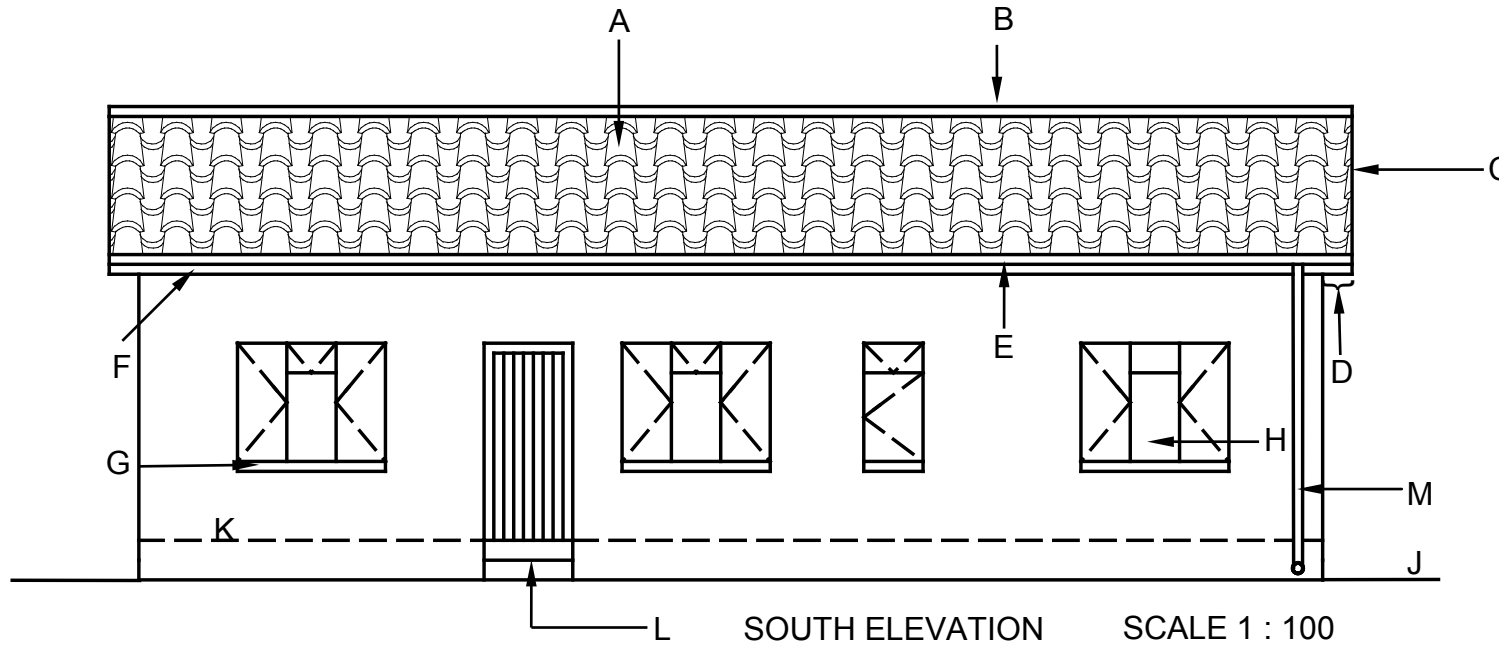
EXAMINATION NUMBER:

QUESTION 6.2

ANSWER SHEET 6.2

| No. | Answer | Mark | LM |
|-------|--------|------|----|
| 6.2.2 | | 1 | |
| 6.2.3 | | 1 | |
| 6.2.4 | | 1 | |

| 6.2.1 | Name of member | Marks | L M |
|--------------|----------------|-----------|-----|
| A | | 1 | |
| B | | 1 | |
| C | | 1 | |
| D | | 1 | |
| E | | 1 | |
| F | | 1 | |
| G | | 1 | |
| H | | 1 | |
| J | | 1 | |
| K | | 1 | |
| L | | 1 | |
| M | | 1 | |
| Total | | 12 | |



FORMULA SHEET

IMPORTANT SYMBOLS

| 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 | $\text{Pi} = \frac{22}{7} = 3,142$ | \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 | 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

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