basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

CIVIL TECHNOLOGY

NOVEMBER 2010

MARKS: 200

TIME: 3 hours

This question paper consists of 15 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 Recommended Code of Practice for Building Drawings.

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 2.7, 4.2, 5.1, 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), for example 1.1.11 M.

COLUMN A	COLUMN B
1.1.1 Site plan	A used to fix metal sheeting onto a roof
1.1.2 Symbols	B an unsupported projecting beam at one end
1.1.3 Pollution	
1.1.4 By-product	C product which is derived from the making of another product
1.1.5 Cutting list	D contamination of water, air or soil
1.1.6 Aids	E disease caused by a virus that is transmitted in body fluids
1.1.7 Excavations	
1.1.8 Permeable material	F digging of trenches, holes, et cetera
1.1.9 Cantilever	G used for cutting materials
1.1.10 Angle grinder	H description and sizes of materials required
	I a top view of the whole site
	J material that absorbs water quickly
	K tension-opposing twisting
	L showing different objects without having to describe them

(10 x 1)   (10)

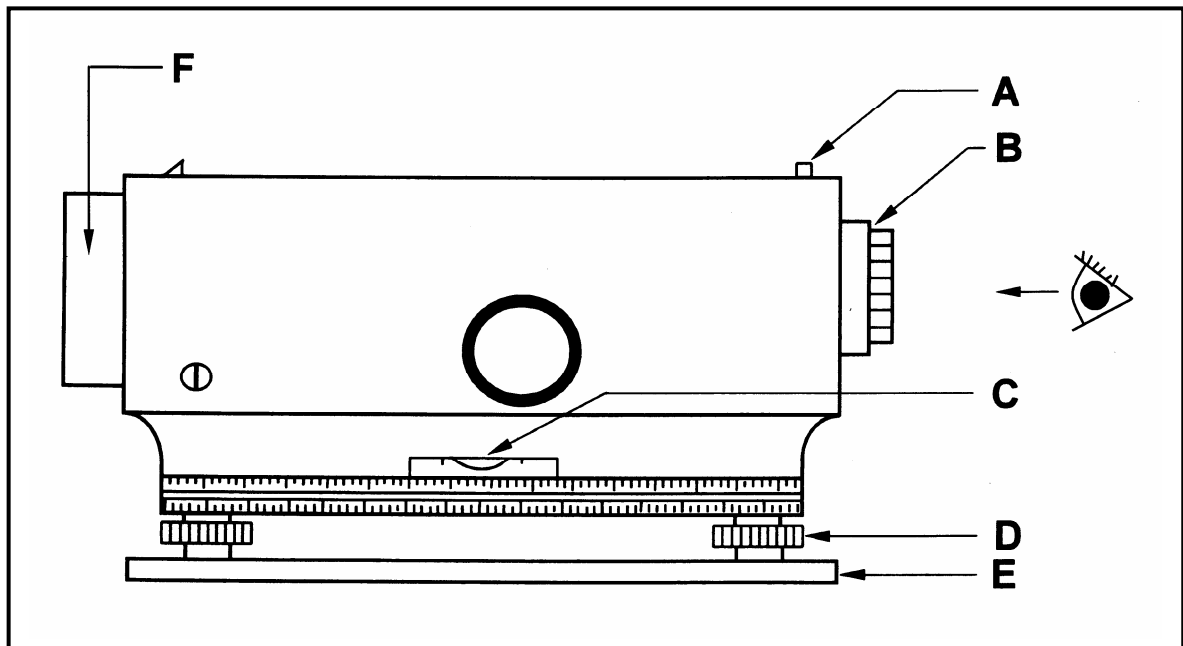1.2   FIGURE 1.2 below shows a dumpy level. Study the illustration and answer the questions that follow.

FIGURE 1.2

1.2.1   Label parts **A** to **F**.   (6)

1.2.2   What accessory is used with this instrument to make accurate readings?   (1)

1.2.3   What does the dumpy level rest on when in use?   (1)

1.2.4   Describe how you would store the dumpy level after use.   (1)

1.3   Draw neat single-line diagrams to illustrate the shape of the following arches. Show only the brickwork of the arches and not the surrounding brickwork.

1.3.1   Flat arch   (2)

1.3.2   Segmental arch   (2)

1.3.3   Semi-circular arch   (2)

1.4   A worker on site has been injured. He has an open wound, which is bleeding heavily. You want to apply first aid to the injured worker.

        Explain the steps you will take to stop the bleeding until medical help arrives. Also take into account your own safety.   (5)
                                                                                                          [30]

QUESTION 2: ADVANCED CONSTRUCTION PROCESSES

2.1   Indicate whether the following statements are TRUE or FALSE.   Choose the answer and write only 'true' or 'false' next to the question number (2.1.1 – 2.1.7) in the ANSWER BOOK.

      2.1.1   The formwork for a rib and block floor must only be removed 14 days after the concrete is cast.   (1)

      2.1.2   A centre is a temporary support for bricks in an arch while the arch is being built.   (1)

      2.1.3   One of the functions of wedges in staircase formwork, is to firmly secure posts under the bearers.   (1)

      2.1.4   A gauged arch will be plastered.   (1)

      2.1.5   Precast piles are never used in swampy areas.   (1)

      2.1.6   Underpinning is used to stabilise the foundation of a sagging building.   (1)

      2.1.7   An advantage of a rough arch is that it is cheaper to make.   (1)

2.2   Name THREE items that are used to ensure that the reinforcement of concrete structures do not come into contact with the formwork while the concrete is being cast.   (3)

2.3   Distinguish between a *short-bored (auger) pile* and a *precast concrete pile.*   (4)

2.4   List FOUR advantages that piled foundations have over other foundations.   (4)

2.5   Name FOUR materials that can be used for the cladding of a wall.   (4)

2.6   List THREE materials that can be used for the construction of the framework for dry-wall frames.   (3)

2.7   The top view of one course of a cross junction of a one-brick wall in English bond (not to scale) is shown on ANSWER SHEET 2.7. Use the plan course on ANSWER SHEET 2.7 to project and draw the consecutive plan course.   (10)

2.8   FIGURE 2.8 below shows the formwork for a round concrete column. Write the letters A to E in your ANSWER BOOK and next to them the names of the parts. Choose the answers from the list below.

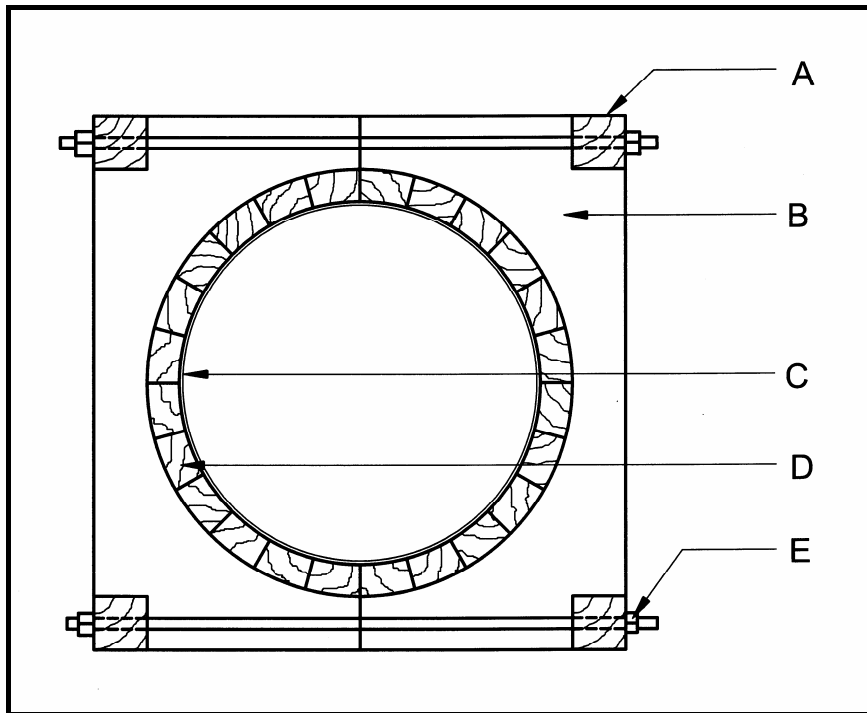lining material; bolt and nut; metal collar/ribs; vertical clamps; laggings; props; clamps

FIGURE 2.8   (5)
[40]

Please turn over

QUESTION 3: CIVIL SERVICES

3.1 FIGURE 3.1 below shows the layout of a one-pipe sewerage system of a residential house in a rural area. Analyse FIGURE 3.1 and answer the following questions.
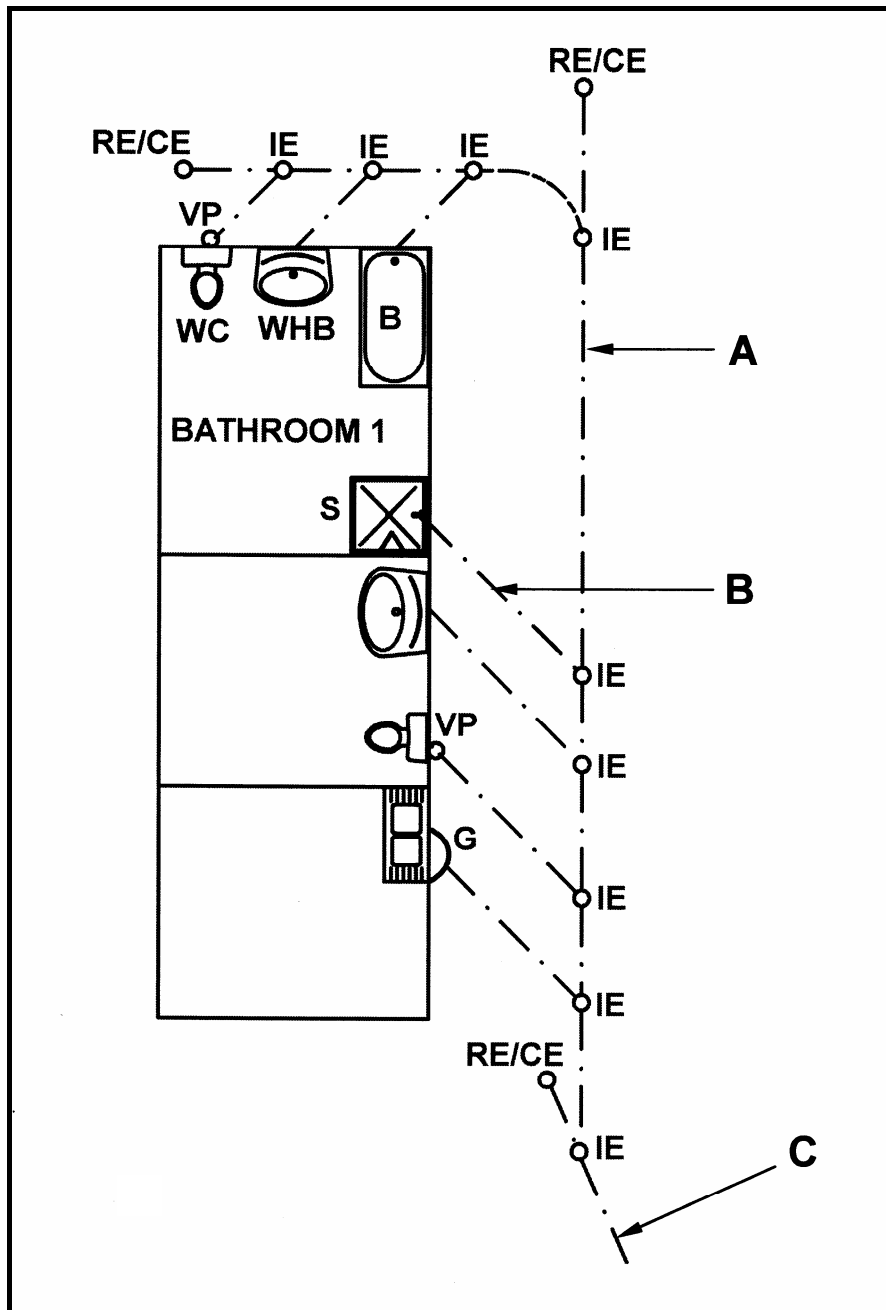

FIGURE 3.1

3.1.1 Identify the pipe labelled **A** (NOT the material). (1)

3.1.2 What is the diameter of pipe **A**? (1)

3.1.3 What is the recommended gradient of pipe **A**? (1)

3.1.4   Identify the pipe labelled **B** (NOT the material).   (1)

3.1.5   At what angle must pipe **B** be connected to pipe **A**?   (1)

3.1.6   To what disposal system must pipe **C** be connected?   (1)

3.1.7   Write out the following abbreviations:

         (a)   WC
         (b)   VP
         (c)   S
         (d)   G
         (e)   B   (5)

3.1.8   How many wash hand basins are indicated on the drawing?   (1)

3.2   Due to rising costs and the insufficient supply of electricity, an increasing number of consumers are resorting to solar energy.

     Briefly explain FOUR factors that must be considered in the installation process of solar panels for a water heating system.   (4)

3.3   Wind is a possible source of generating energy in rural areas. Name FOUR advantages associated with wind power.   (4)

3.4   Symbols are used on floor plans to show electrical installations and items. Make neat sketches to illustrate the following electrical symbols:

3.4.1   Meter box   (2)

3.4.2   Distribution board   (2)

3.4.3   Fluorescent light (two tubes of 40 watts)   (2)

3.4.4   Two-way light switch   (2)

3.4.5   Wall-mounted light   (2)
                                                         [30]

QUESTION 4: MATERIALS AND QUANTITIES

4.1   Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A – D) next to the question number (4.1.1 – 4.1.5) in the ANSWER BOOK, for example 4.1.6 B.

      4.1.1   ... is the most suitable timber to use for the construction of doors and windows.

           A   Balsa
           B   Meranti
           C   Jelutong
           D   Chipboard   (1)

      4.1.2   ... is the correct fastener to secure gusset plates to members of a steel roof truss.

           A   Bolts and nuts
           B   Self-tapping screws
           C   G clamps
           D   Wire nails   (1)

      4.1.3   Capillary joints for water supply pipes are used in ... pipes.

           A   galvanised
           B   plastic
           C   PVC
           D   copper   (1)

      4.1.4   ... is the correct adhesive to join plastic conduits.

           A   PVC adhesive
           B   PVA glue
           C   Contact adhesive
           D   Grease   (1)

      4.1.5   Which ONE is the most suitable material to seal eaves?

           A   Chipboard
           B   Shade cloth
           C   Cement fibre board
           D   Gypsum board   (1)

4.2   FIGURE 4.2 below illustrates the front view and isometric view of a free-
        standing clothing cupboard, made out of melamine board, with a 3 mm
        masonite (hardboard) back. The doors are omitted in the isometric view to
        show more details.

        Use the following specifications:

        •   Two shelves
        •   A hanging rail
        •   A 90 mm high receding base (plinth)
        •   The external dimensions of the cupboard are:

            ➤   Height: 1 890 mm
            ➤   Width: 900 mm
            ➤   Depth: 550 mm
            ➤   Thickness of melamine board: 16 mm
            ➤   Masonite (hardboard): 3 mm (for back)

        Complete the cutting list on ANSWER SHEET 4.2.
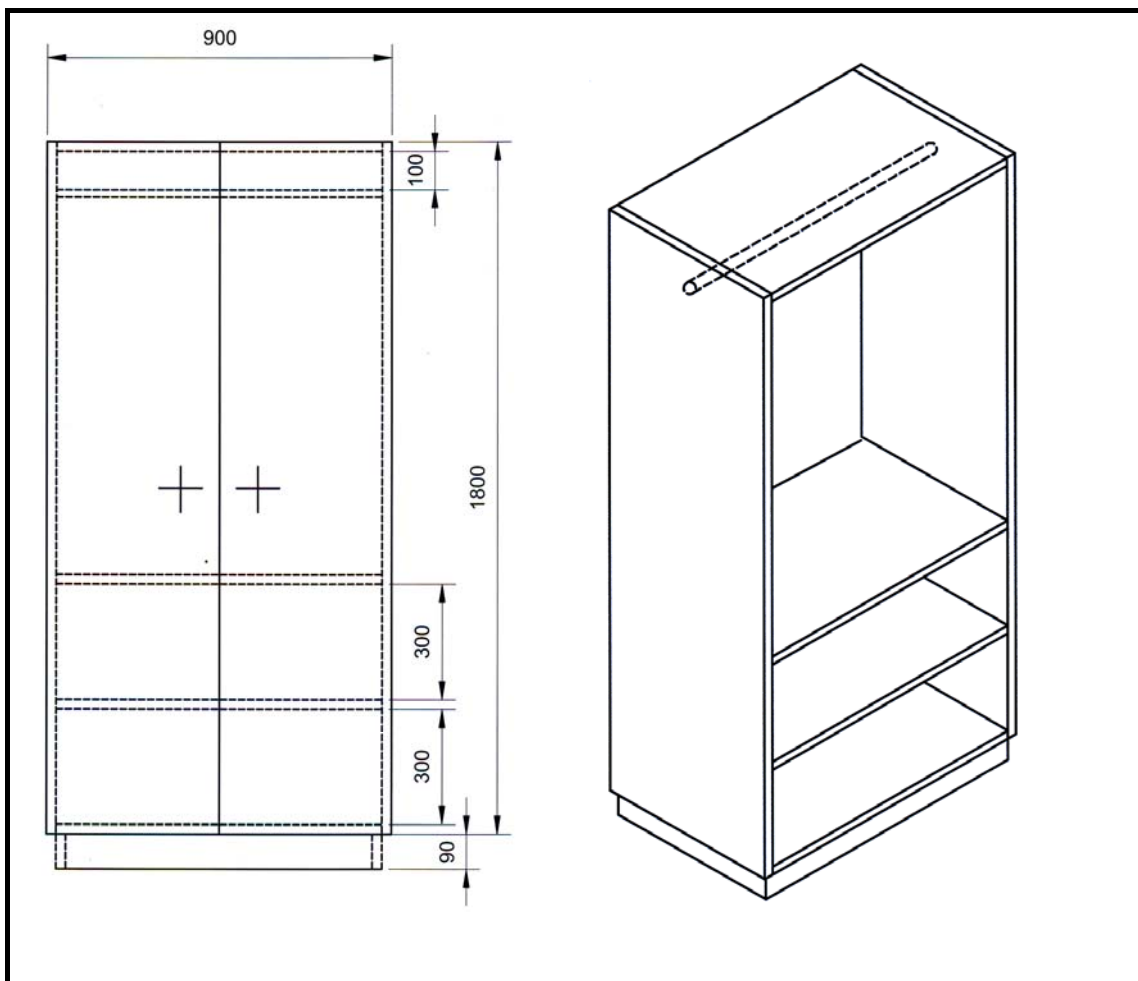
FIGURE 4.2   (14)

4.3   Answer the following questions in connection with a cube test:

        4.3.1   What is the purpose of a cube test?   (1)

        4.3.2   What is the size of the cube?   (1)

        4.3.3   Name the apparatus needed to prepare a cube.   (3)

        4.3.4   What treatment must the mould receive before the concrete is
                  placed into it?   (2)

4.4   You are an architect and have advised a client to use aluminium windows and
        doors to develop a site at the coast.

        Give THREE reasons why you have recommended the use of this material.   (3)

4.5   What type of fastener is used to join members of a timber roof truss to one
        other?   (1)
                                                                             [30]

QUESTION 5: APPLIED MECHANICS

5.1   FIGURE 5.1 below shows the space diagram of a cantilever roof truss.
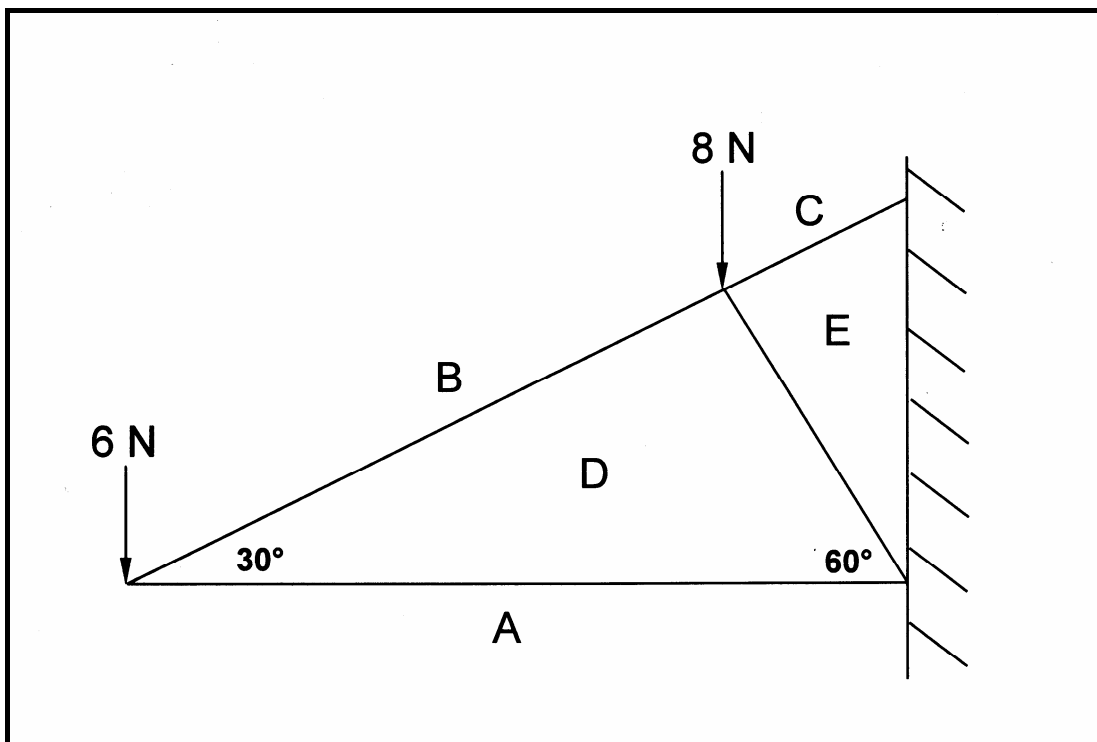
FIGURE 5.1

        Use ANSWER SHEET 5.1 and determine graphically the magnitude and the
        nature of the forces in EACH member (part) of the truss. Use scale
        10 mm = 1 N.   (12)

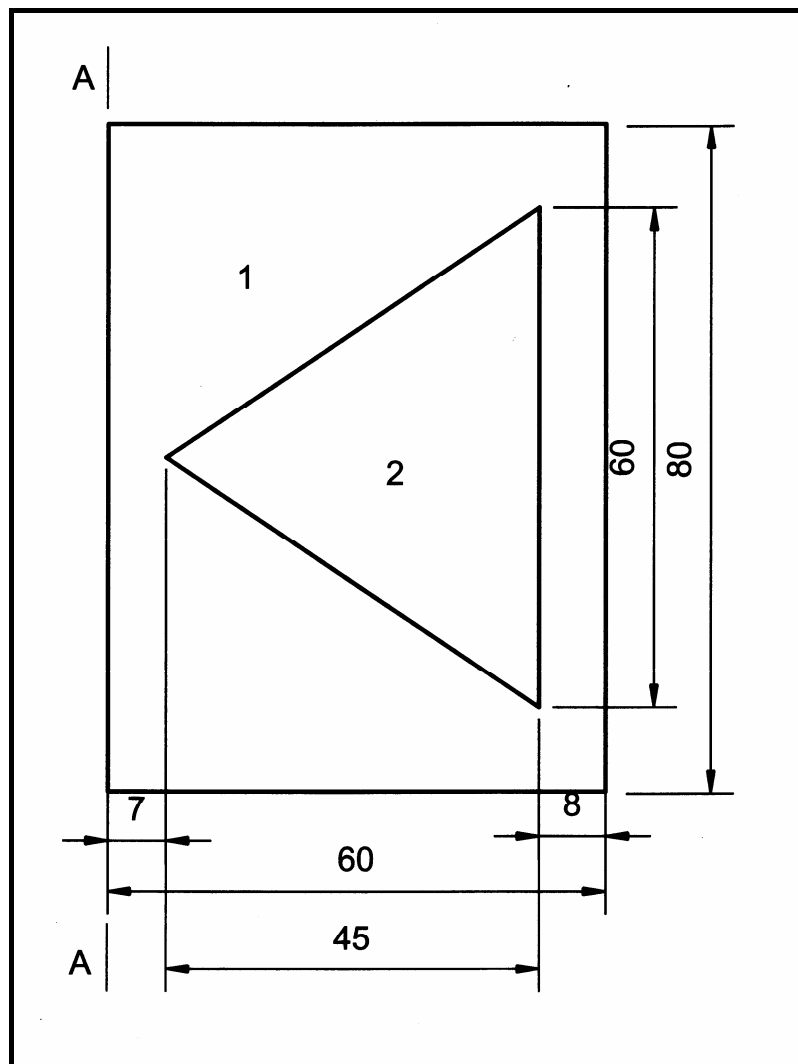5.2   FIGURE 5.2 below shows the lamina of a figure with a triangular hole in it. ALL dimensions are in millimetres.

FIGURE 5.2

5.2.1   Calculate the total area of the lamina.   (6)

5.2.2   Calculate the position of the centroid from A-A.   Round your answer off to TWO decimal places.   (8)

5.3   A steel rod when subjected to a load increases in length by 0,4 mm. Calculate the deformation (strain) if the original length of the rod is 1,6 m.   (4)

[30]

QUESTION 6: GRAPHIC COMMUNICATION

6.1   FIGURE 6.1 below illustrates the site plan of a dwelling.   Analyse the drawing
        and complete the table on ANSWER SHEET 6.1.
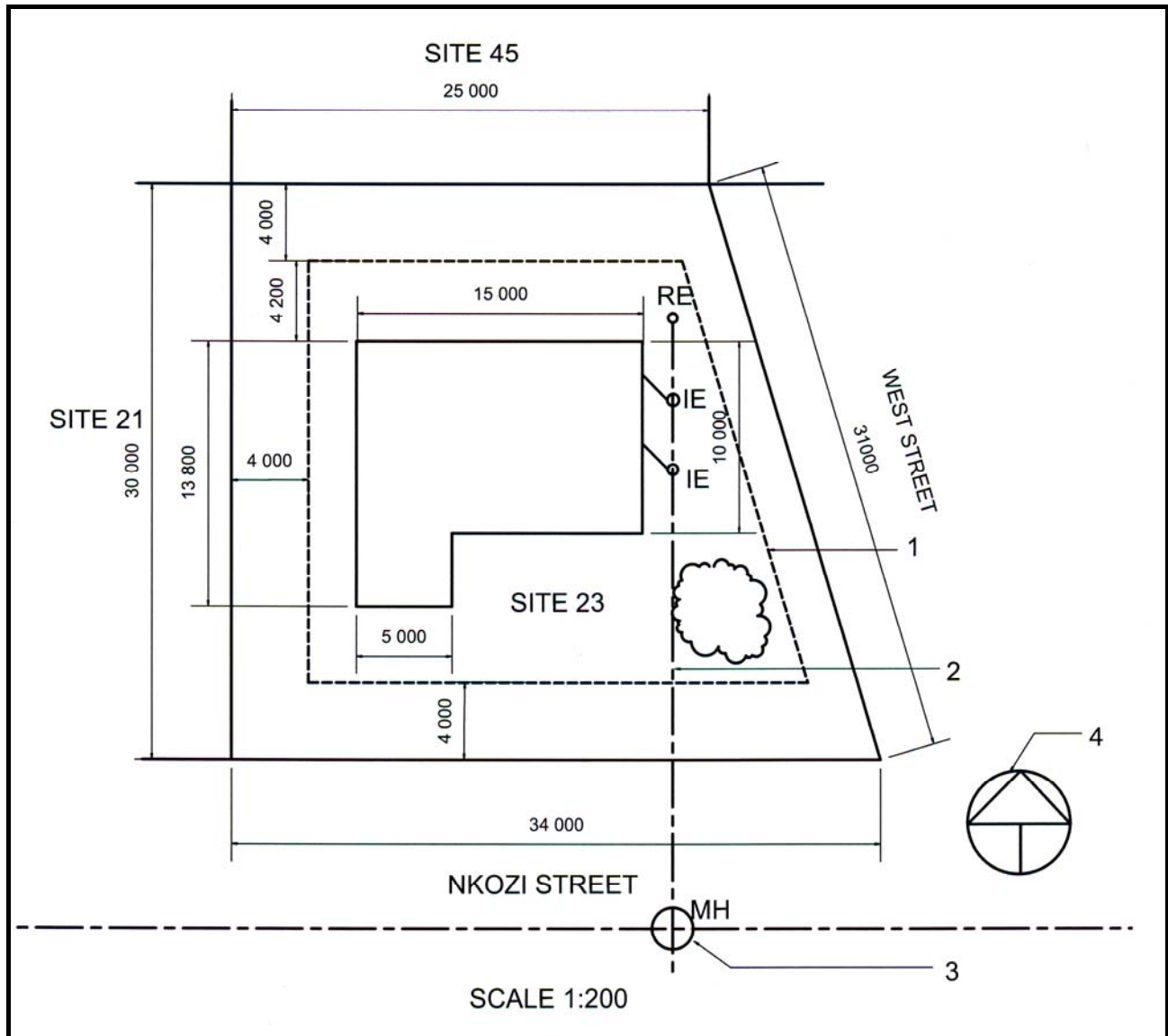
FIGURE 6.1

(15)

6.2   FIGURE 6.2 below shows the floor plan of a proposed building. Draw to scale 1 : 50 on ANSWER SHEET 6.2 the NORTH ELEVATION of the building. Use the specifications as indicated on the next page.
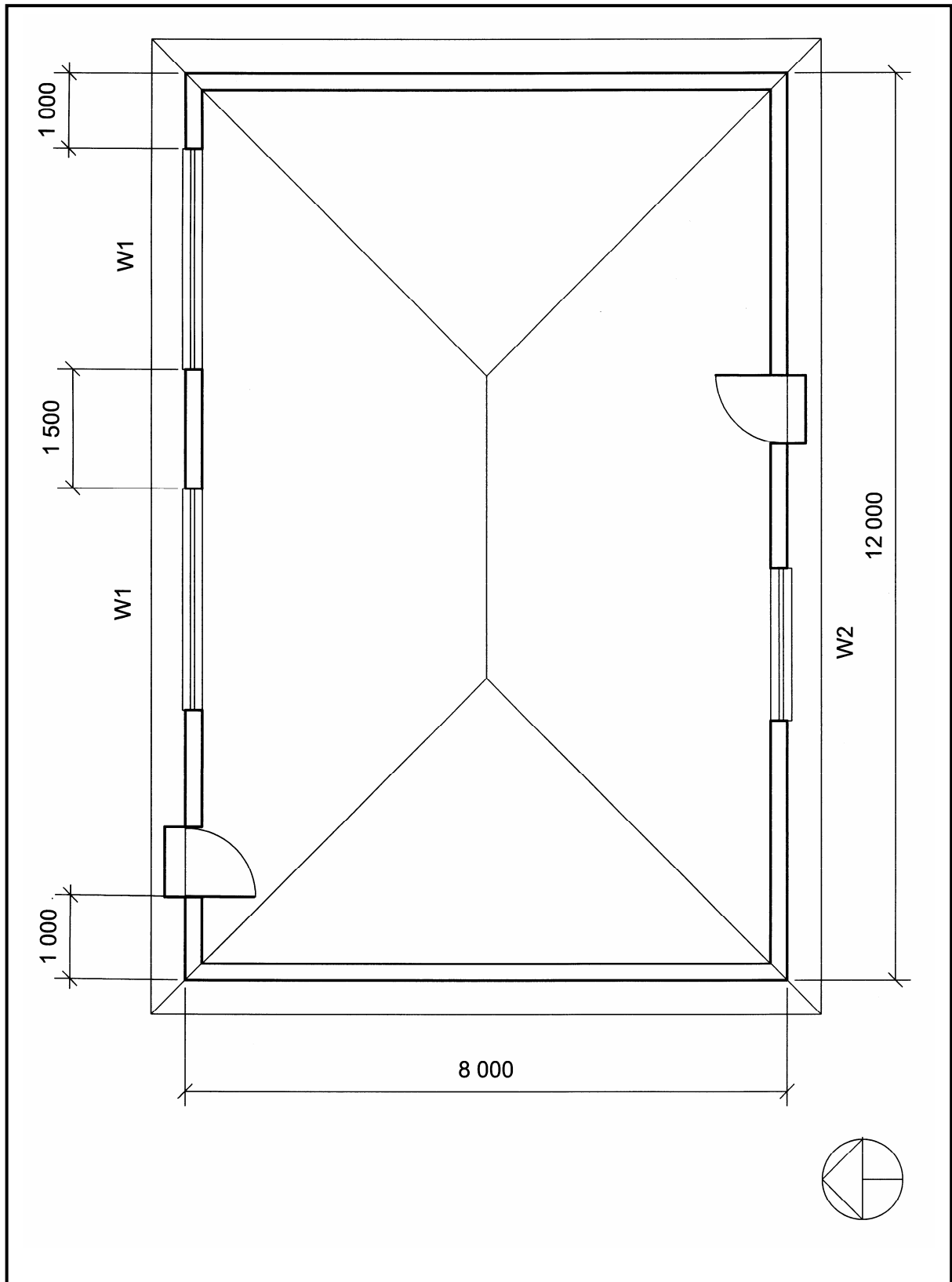
FIGURE 6.2

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.
- Rain-water pipes are 75 mm in diameter and 100 mm square gutters are used.
- The height between the top level of the floor slab and the underside of the wall plate is 2 600 mm.
- The height between the natural ground level and the top level of the floor slab is 300 mm.
- The eaves overhang is 450 mm.
- The door step is 150 mm high.
- This building has a hipped roof with a pitch of 30°.

Show the following on your drawing:
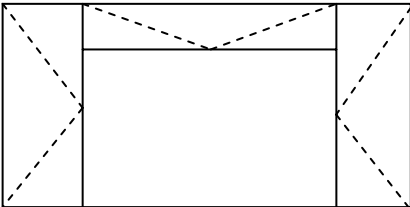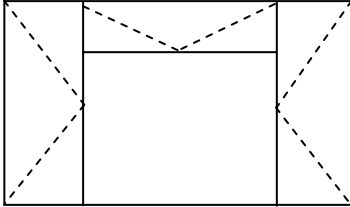
- The method of determining the roof height
- Window sills

(18)

Show the following labels on your drawing:

- Natural ground level (NGL)   (1)
- Floor level (FL)   (1)
- Type of wall finishing   (1)
- Roof pitch   (1)
- Roof covering   (1)
- Title   (1)
- Scale   (1)

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

[40]

TOTAL: 200

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

EXAMINATION NUMBER | | | | | | | | | | | | |

QUESTION 2.7

ANSWER SHEET 2.7
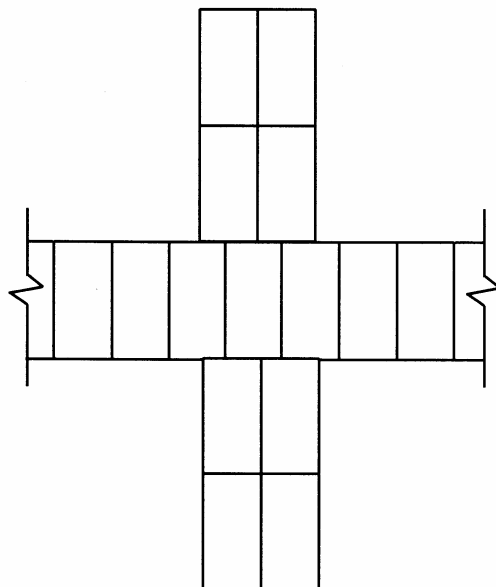
CRITERIA	MARK ALLOCATION
Correctness	8
Line quality	1
Neatness	1
TOTAL	10

QUESTION 4.2

ANSWER SHEET 4.2

No.	DESCRIPTION	NUMBER REQUIRED	SIZE REQUIRED		
			L	W	T
1	SIDES			550	16
2	TOP			550	16
3	BOTTOM			550	16
4	SHELVES			550	16
5	PLINTH – FRONT			90	16
6	BACK			900	3
7	DOORS			450	16

(14)

CENTRE NUMBER:

EXAMINATION NUMBER

QUESTION 5.1

ANSWER SHEET 5.1

a ⊥

(4)

MEMBER	NATURE	MAGNITUDE
BD		
CE		
DE		
AD		

(8)

CENTRE NUMBER: | | | | | | | |

EXAMINATION NUMBER | | | | | | | | | | | |

QUESTION 6.1

ANSWER SHEET 6.1

NO.	QUESTIONS	ANSWERS	MARKS
1	What is the scale of the drawing?		1
2	What is the site number on the northern side of the proposed building?		1
3	Give the meaning of the abbreviation IE.		1
4	What is the total area of the house?		2
5	Give the meaning of the abbreviation RE.		1
6	Identify number 1.		1
7	What colour must be used on a building plan to indicate number 2?		1
8	Identify number 3.		1
9	Identify number 4.		1
10	What is the street name on the southern side of the house?		1
11	What is the number of the site on which the proposed building is to be erected?		1
12	What is the distance between the house and the boundary of site number 45?		1
13	What colour is used to indicate new additions to an existing building?		1
14	What is the total perimeter of the building?		1

(15)

CENTRE NUMBER:

EXAMINATION NUMBER

QUESTION 6.2

ANSWER SHEET 6.2

(25)

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

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

OR

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

Deformation (strain) = $\frac{\text{Change in length (mm)}}{\text{Original length (mm)}}$