



**CIVIL TECHNOLOGY**

Time: 3 hours

200 marks

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**PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY**

1. This question paper consists of 11 pages and an Answer Booklet of 4 pages (i – iv). Please check that your paper is complete.
2. Read all the questions carefully.
3. Answer ALL the questions.
4. Answer each question as a whole, do not separate sub questions.
5. Sketches may be used to illustrate your answer.
6. Use the mark allocation as a guide to the length of your answers.
7. 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.
8. For the purpose of this paper, the size of a brick should be taken as 220 mm × 110 mm × 75 mm.
9. Use your own discretion where dimensions and/or details have been omitted.
10. Drawings in this question paper are not to scale due to electronic transfer.

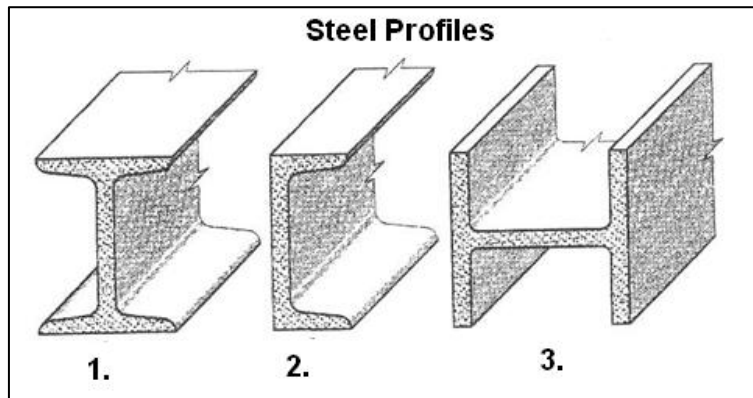
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**REQUIREMENTS:**

1. Drawing instruments
  2. A non-programmable calculator
  3. Answer Booklet
  4. Colour pens
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**QUESTION 1 CONSTRUCTION PROCESSES**

- 1.1 You are a safety inspector on a building site. Write down **THREE** specific safety rules you will inspect regarding the following aspects on the site.
  - 1.1.1 Trenches deeper than 1,5 m (Protect workers) (3)
  - 1.1.2 Scaffolds (3)
  - 1.1.3 Stacking of material (3)
- 1.2 Figure 1.2 shows **THREE** different profiles of metal that can be found on a building site. Name each of the different profiles shown. (3)



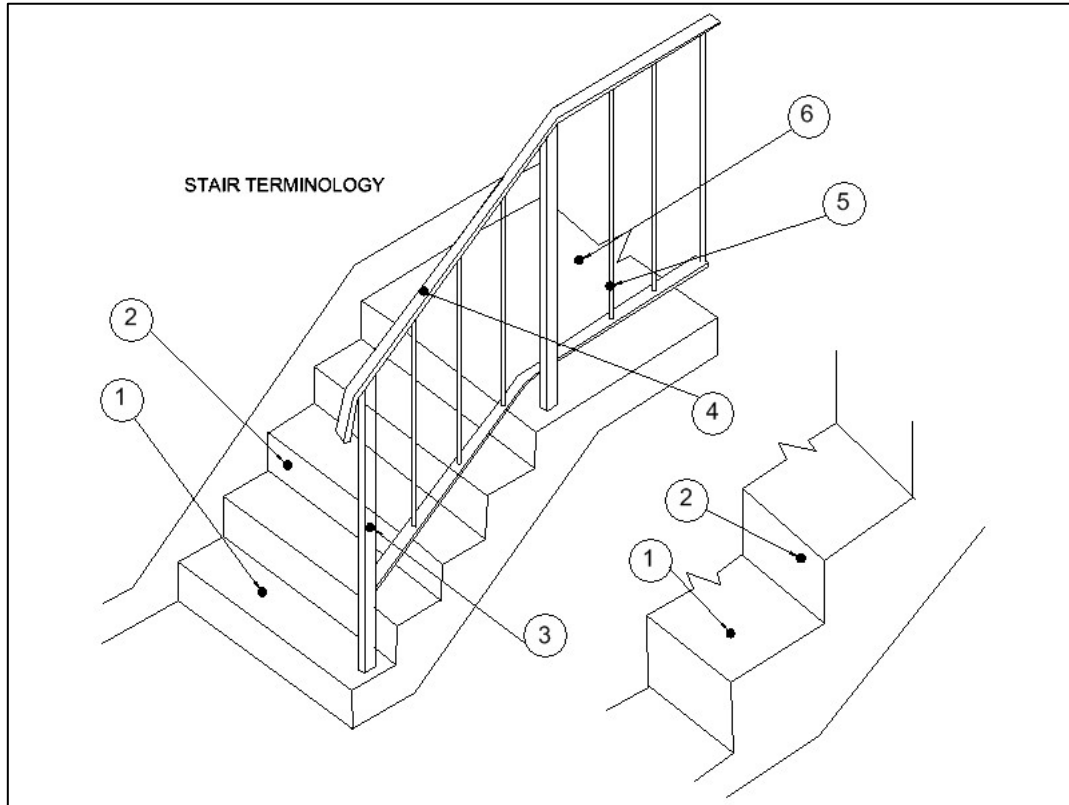
**Figure 1.2**

- 1.3 While you are visiting a building site you hear the following terminology used by the workmen. Give a brief explanation of the following terms that you heard.
  - 1.3.1 Bolster (1)
  - 1.3.2 Scaffold (1)
  - 1.3.3 Profile board (1)
  - 1.3.4 Brick force (1)
  - 1.3.5 Cladding (1)
  - 1.3.6 Datum (1)
- 1.4 Formwork may be described as a moulded box into which concrete is poured to achieve a certain shape or column. Describe **FOUR** requirements that formwork must adhere to so that it is viable for use. (4)
- 1.5 Glazing is the placement of glass into a building. Name any **TWO** different types of glass available and where the glass you named will be used in the house. (4)
- 1.6 A person has cut himself badly on his hand and is bleeding profusely (heavily). State the steps you will take to help him and indicate how you will ensure your own safety. (4)

**[30]**

**QUESTION 2      ADVANCED CONSTRUCTION**

2.1 Figure 2.1 below shows a sketch of a staircase. Write down the numbers 1 – 6 below one another and next to the number the specific terminology used for that part of the staircase as indicated. (6)



**Figure 2.1**

2.2 You are a training officer on a building site and want to help the workers understand the following terminology used. Indicate by means of a simple sketch the difference between the following for the workers.

2.2.1 Raking shore and Flying shore (4)

2.2.2 Barge board and Fascia board (4)

2.2.3 Semi-circular arch and Gauged segmental arch (4)

2.2.4 Stretcher brick bond and an English brick bond (4)

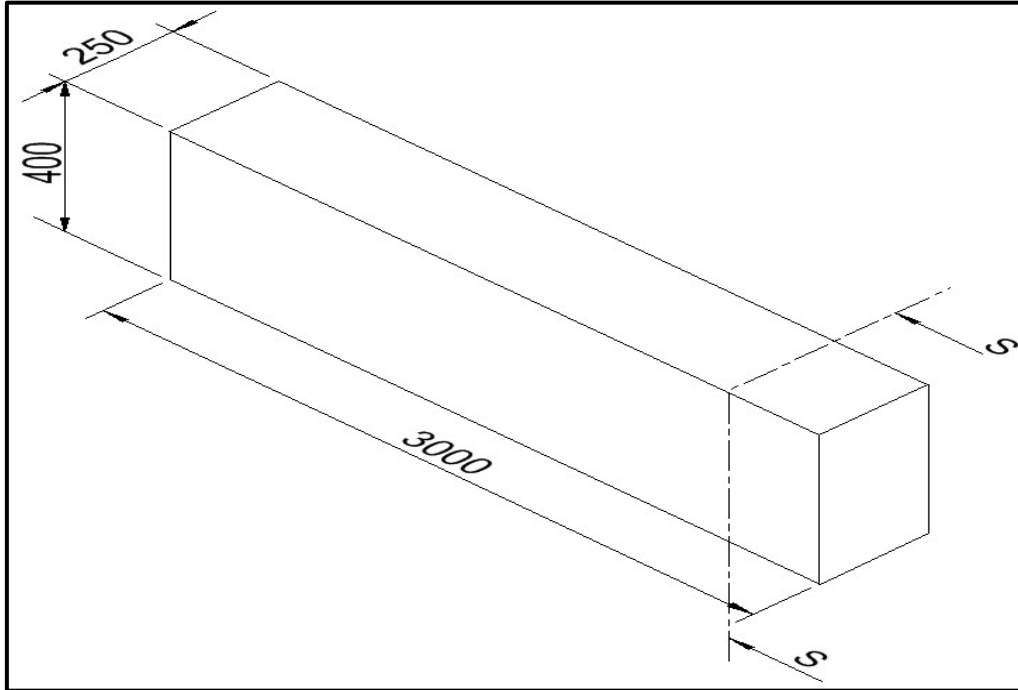
2.3 Reinforcement is used in beams to counteract certain forces acting on the beam. The following numbers were seen on a reinforcement bar schedule. Explain to your fellow worker what these numbers and letters mean.

**8Y 20 01-250** (5)

2.4 Figure 2.4 shows a beam that was cast *in situ*. Draw to a scale of 1:5 a detailed cross section on cutting plane SS.

- Label the different parts of the sectional drawing using the list below. (6)

Main bars, Anchor bars, Stirrups, Shear bar



**Figure 2.4**

2.5 A gusset plate is used for bolting or welding steel structural components together. Name FOUR specifications needed to draw a gusset. (4)

2.6 Draw neatly what the reading **2350** on the telescopic staff will look like, when looking through the eye piece of the dumpy level. (3)  
**[40]**

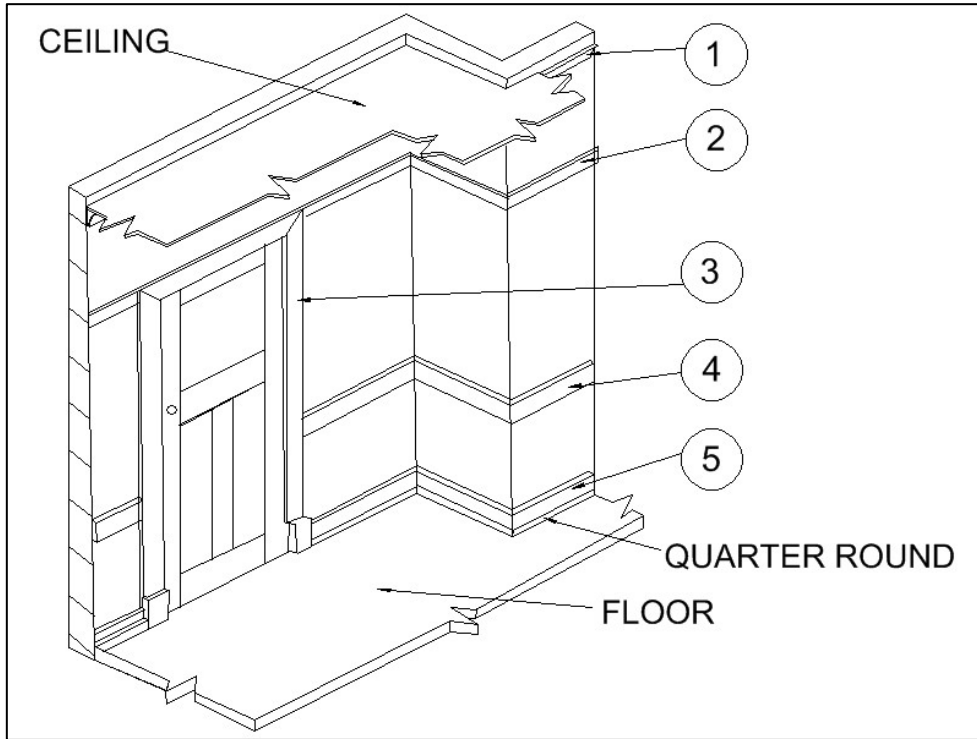
**QUESTION 3      CIVIL SERVICES**

- 3.1 Figure 3.1 on the Answer Sheet shows a line diagram of a bathroom with three sanitary fittings and the main connection. Use Figure 3.1 on the Answer Sheet and design and draw an appropriate sewage system.
- Use all regulations and design principles.
  - Indicate all abbreviations, pipe details and colours where applicable. (8)
- 3.2 Write down the numbers 3.2.1 – 3.2.4 below one another and next to the number the abbreviation for the sanitary fittings.
- 3.2.1 Hand wash basin (1)
- 3.2.2 Water-closet (toilet) (1)
- 3.2.3 Sink (1)
- 3.2.4 Shower (1)
- 3.3 Name FIVE drainage principles that must be taken into account to make drains more effective and reachable. (5)
- 3.4 Name THREE tests that can be used to ensure the drain pipes are watertight, laid straight and the pipe is free from obstructions. (3)
- 3.5 South Africa mostly uses fossil fuel to generate electricity. Name TWO other sources that are used to generate electricity. (2)
- 3.6 Your friend in Grade 12 wants to install a solar system with a hot water cylinder feeding their existing geyser at home. He wants to know how this works and why this has to be done.
- 3.6.1 Draw and label a simple single line diagram to show your friend how this solar system will fit with his existing geyser. (6)
- 3.6.2 State TWO reasons why a solar system is more viable than the usual electrical geyser. (2)
- [30]**

**QUESTION 4 MATERIALS AND QUANTITIES**

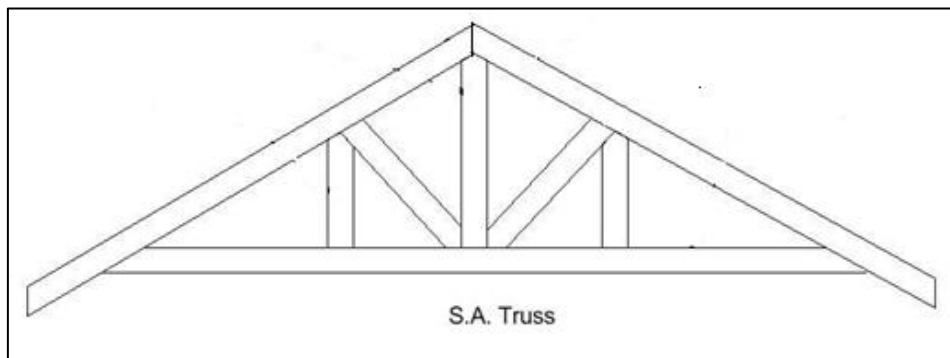
4.1 Mouldings used in the house are functional and are used to fill corners or soften outer corners. Mouldings can be decorative and functional. Study Figure 4.1 below and answer the question that follows.

Write down the numbers 1 – 5 below one another and next to the number, the name/terminology used for that specific moulding used in the house. (5)



**Figure 4.1**

4.2 Figure 4.2 below shows the SA roof truss with a cutting list. Determine the cost for the truss if it costs **R45/running meter** for SA Pine 114 mm × 38 mm. (3)



**Figure 4.2**

Description	Quantity	Length	Width	Thickness
Tie beam	1	8 000	114	38
Rafters	2	5 500	114	38
King post	1	2 400	114	38
Queen post	2	1 200	114	38
Brace/Strut	2	2 250	114	38

4.3 You are planning to mix concrete for a  $3\text{ m} \times 3\text{ m} \times 75\text{ mm}$  thick slab and will use the ratio: 4:3:3 (4 stone, 3 sand and 3 cement) for your batch of concrete. The volume of concrete needed for the slab is  $0.675\text{ m}^3$ . The volume of a concrete wheelbarrow is  $0.033\text{ m}^3$ . Determine the number of wheelbarrows (**stone**) that you will need for the slab. (3)

4.4 The slump test is used for testing the consistency of concrete.

4.4.1 Name the equipment used during a slump test. (3)

4.4.2 Sketch and label TWO different slumps that will indicate:

(i) too much water in the slump. (2)

(ii) ingredients in concrete not mixed correctly. (2)

4.5 Figure 4.5 below shows the plan view of a small dwelling. On the Answer Sheet provided use the four column method to determine the total number of bricks for the superstructure only.

- \*\*\*\*\* Superstructure height = 2 800 mm
- \*\*\*\*\* Windows = 1 500 mm × 1 000 mm
- \*\*\*\*\* Door = 2 000 mm × 900 mm
- \*\*\*\*\* Number of bricks = 52 bricks/m<sup>2</sup>
- \*\*\*\*\* External walls = Single brick 220 mm

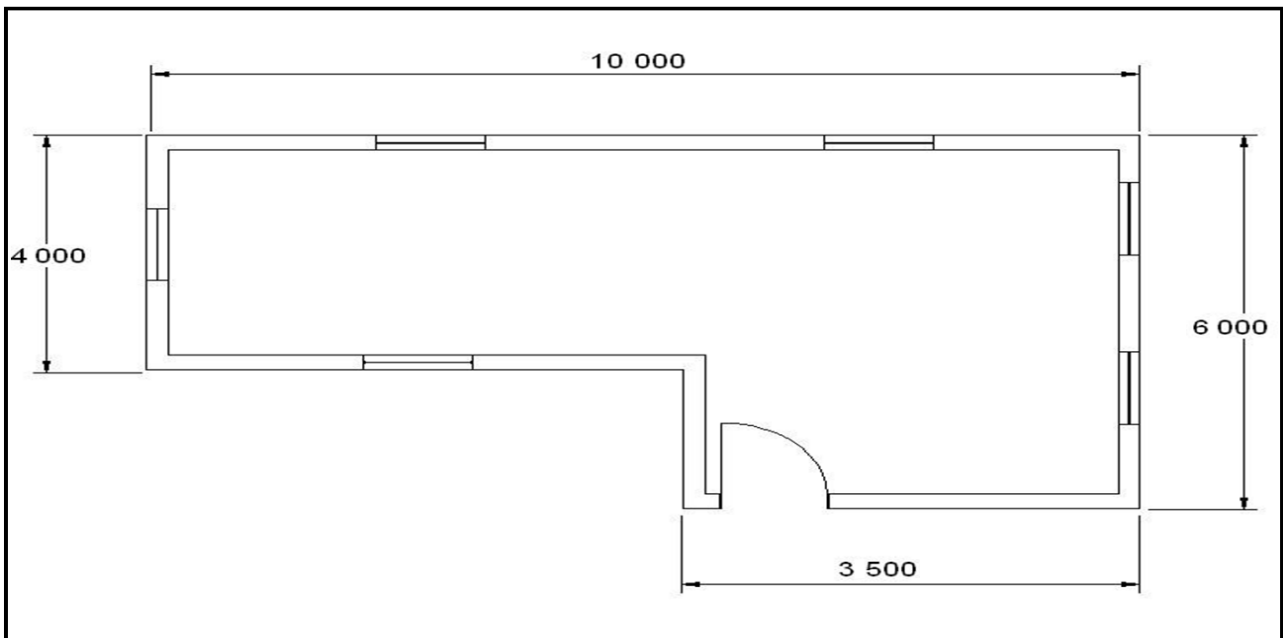


Figure 4.5

(12)  
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**QUESTION 5      APPLIED MECHANICS**

5.1 Give a brief explanation of the following terms:

5.1.1 Weight of an object (1)

5.1.2 Dynamic load on an object (1)

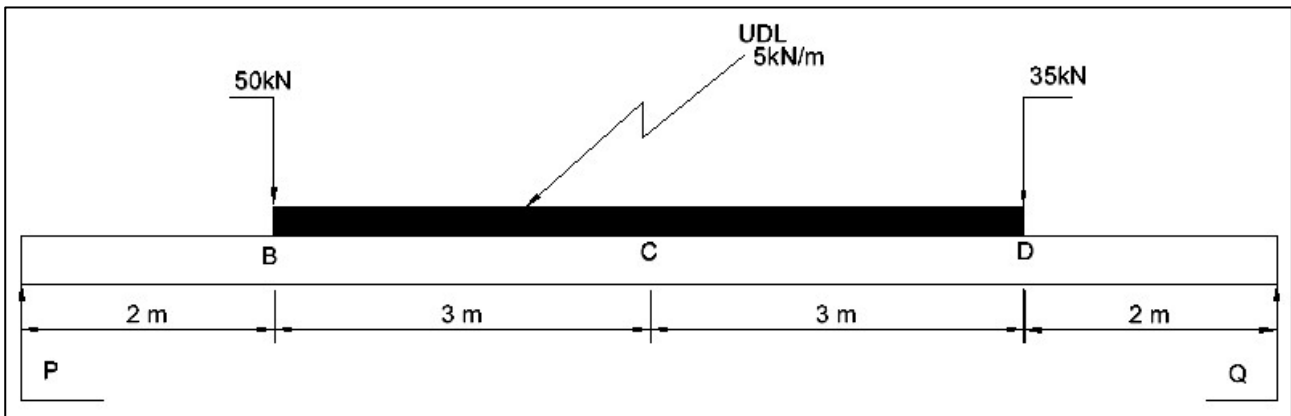
5.1.3 Resultant of forces (1)

5.2 Figure 5.2 below shows a simple beam with a uniform distributed load.

5.2.1 Determine the reaction forces at P and Q. (5)

5.2.2 Calculate the bending moments at B, C and D. (3)

5.2.3 Calculate the shear force at SFB-B, SFC-C and SFD-D of the simple beam. (3)



**Figure 5.2**



5.3 Figure 5.3 below shows a frame work for a truss.

5.3.1 Draw the force diagram for the roof truss. Scale 1 N = 5 mm (6)

5.3.2 Copy the table below in your Answer Book and state the nature and magnitude of each member. (6)

MEMBER	MAGNITUDE	NATURE
<b>BF</b>		
<b>DE</b>		
<b>FG</b>		

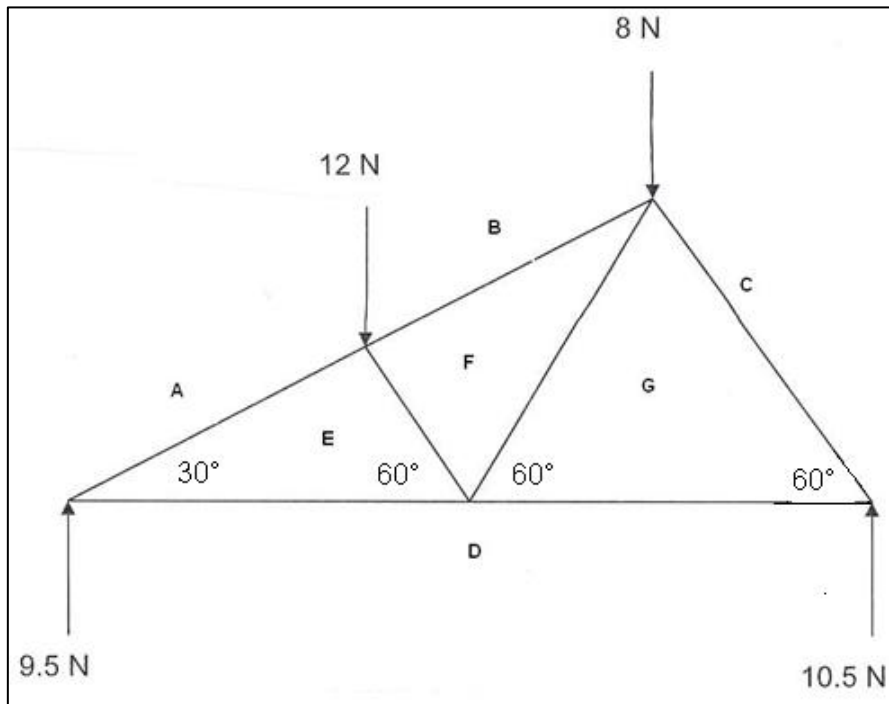


Figure 5.3

5.4 A square bar 500 mm in length that is 10 mm × 10 mm is subjected to a load of 50 kN. The bar lengthens with 0,5 mm when the load is applied. Calculate the stress of the square bar.

**Formulae:**

$$E = \frac{\text{Stress}}{\text{Strain}} \quad \text{Stress} = \frac{\text{Load}}{\text{Cross section area}} \quad \text{Strain} = \frac{\text{Deformation}}{\text{Original length}} \quad (4)$$

[30]

**QUESTION 6          GRAPHICS AND COMMUNICATION**

6.1 Figure 6.1 shows the plan view of a dwelling. Study the plan carefully and answer the questions that follow on the Answer Sheet provided.

6.1.1 On the Answer Sheet provided, draw a detailed sectional of cutting plane AA to scale 1:50. (15)

6.1.2 Draw to scale 1:50 the West elevation of the building on the Answer Sheet provided. (Use specifications shown below.)

**Specifications:**

- The building has a gable roof with 30 degree slope.
- Closed eaves with an overhang of 600 mm.
- Verge is 200 mm.
- Barge board is 250 mm wide.
- Fascia board is 250 mm wide.
- No down pipes are required.
- The external door is 2 000 mm high and 900 mm wide.
- The height between finished floor level and underside of the wall plate is 2 800 mm.
- Height between natural ground level and finished floor level is 300 mm.
- Door step is 150 mm high.
- Foundation for external wall is 600 mm × 400 mm.
- Foundation for internal wall is 400 mm × 200 mm.
- Foundation brick is three courses below natural ground line.
- Plaster is 12 mm thick. (25)

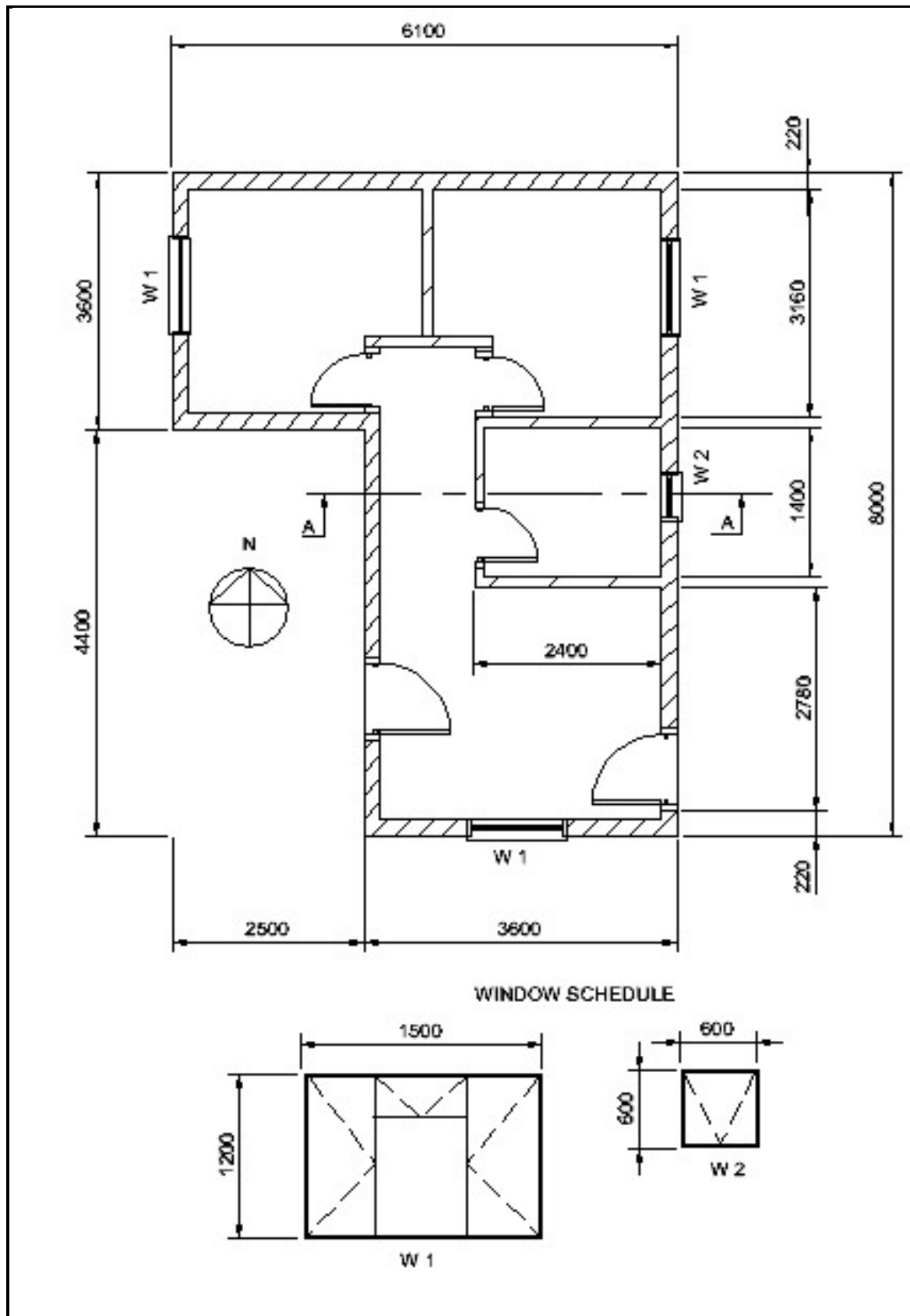


Figure 6.1

[40]

Total: 200 marks