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# **NATIONAL SENIOR CERTIFICATE**

**GRADE 12**

**SEPTEMBER 2022**

**CIVIL TECHNOLOGY: CONSTRUCTION**

**MARKS: 200**

**TIME: 3 hours**

This paper consists of 16 pages, including 2 answer sheets.

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**REQUIREMENTS:**

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

**INSTRUCTIONS AND INFORMATION**

1. This question paper consists of SIX questions: TWO questions are generic and FOUR questions are subject specific.
2. Answer ALL the questions.
3. Answer each question as a whole. Do NOT separate subsections of questions.
4. Start the answer to EACH question on a NEW page.
5. Do NOT write in the margins 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. Make drawings and sketches 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 2.1 and 5.2 on the attached ANSWER SHEETS using drawing instruments where necessary.
13. Write your NAME on every ANSWER SHEET and hand them in with your ANSWER BOOK, whether you have answered the question or not.
14. Owing to electronic transfer, drawings in the question paper are NOT to scale.

**QUESTION 1: SAFETY AND MATERIALS (GENERIC)**

Start this question on a NEW page

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- 1.1 Define the term *accident*. (2)
- 1.2 Name the material that scaffolding is made from. (1)
- 1.3 Choose the correct answer between brackets that is related to scaffolding:
- 1.3.1 The safety factor that is used for scaffolding frames is (one / two / three). (1)
- 1.3.2 The minimum thickness of a wooden scaffold platform is (38 mm / 50 mm / 76 mm). (1)
- 1.3.3 The minimum height of a suspended scaffold is (900 mm / 1 200 mm / 1 500 mm). (1)
- 1.4 Give TWO reasons why scaffolding must be inspected before it can be used. (2 x 1) (2)
- 1.5 What is the maximum distance that a suspended scaffold may hang over the edge of the structure? (1)
- 1.6 What is the maximum height of a trestle scaffold? (1)
- 1.7 Answer the following questions with regard to ladders.
- 1.7.1 Why should only one person at a time use a ladder? (1)
- 1.7.2 What should the end of a ladder be marked with for visibility when it is transported? (1)
- 1.7.3 Name ONE material that ladders can be made from. (1)
- 1.7.4 Why should ladders be kept clean and free from oil and grease? (1)
- 1.8 Name TWO advantages of a water-based paint. (2 x 1) (2)
- 1.9 Name TWO advantages of the curing of concrete. (2 x 1) (2)
- 1.10 Name TWO methods that can be used to prevent the corrosion of metals. (2 x 1) (2)
- [20]**

**QUESTION 2: GRAPHICS, JOINING AND EQUIPMENT (GENERIC)**

Start this question on a NEW page.

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- 2.1 FIGURE 2.1 on ANSWER SHEET A shows the outer lines of a structure which must be built on a site. Draw the site plan on scale 1 : 200 on ANSWER SHEET A so that the structure is in the middle of the site.

The site plan must comply with the following requirements.  
Use the points table on SHEET A as reference.

- |       |                                                                                          |     |
|-------|------------------------------------------------------------------------------------------|-----|
| 2.1.1 | Site size is 30 m wide from east to west and 40 m long from south to north.              | (2) |
| 2.1.2 | Pavement of 2 m and the street of 6 m on the south side.                                 | (3) |
| 2.1.3 | Building boundaries are 2 m on the east, north and west sides and 4 m on the south side. | (4) |
| 2.1.4 | 3 m wide entrance to the site.                                                           | (2) |
| 2.1.5 | Datum level in the north-west corner of the site.                                        | (2) |

Draw in the sewer lay-out for the structure and show the following:

- |        |                                         |     |
|--------|-----------------------------------------|-----|
| 2.1.6  | Water closet symbol at the abbreviation | (1) |
| 2.1.7  | Sewer pipes connections                 | (2) |
| 2.1.8  | Rodding eye with the abbreviation       | (2) |
| 2.1.9  | Inspection eye with the abbreviation    | (2) |
| 2.1.10 | Manhole with the abbreviation           | (2) |

Indicate the following measurements:

- |        |                                                    |     |
|--------|----------------------------------------------------|-----|
| 2.1.11 | Length and width of the site                       | (4) |
| 2.1.12 | South and west building boundaries                 | (2) |
| 2.2    | What is the advantage of the square shoulder bolt? | (1) |

2.3 Name parts **A** to **D** of the bolt in FIGURE 2.3.

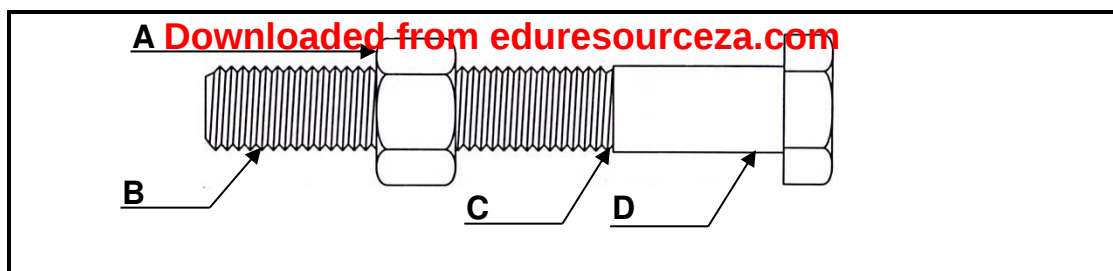


FIGURE 2.3

(4 x 1) (4)

2.4 What is the purpose of the nylon insert of a hexagonal nut? (1)

2.5 What is the advantage of a wing nut? (1)

2.6 FIGURE 2.6 shows the dumpy level reading which is taken on the telescopic staff. Answer the following questions with regard to the reading.

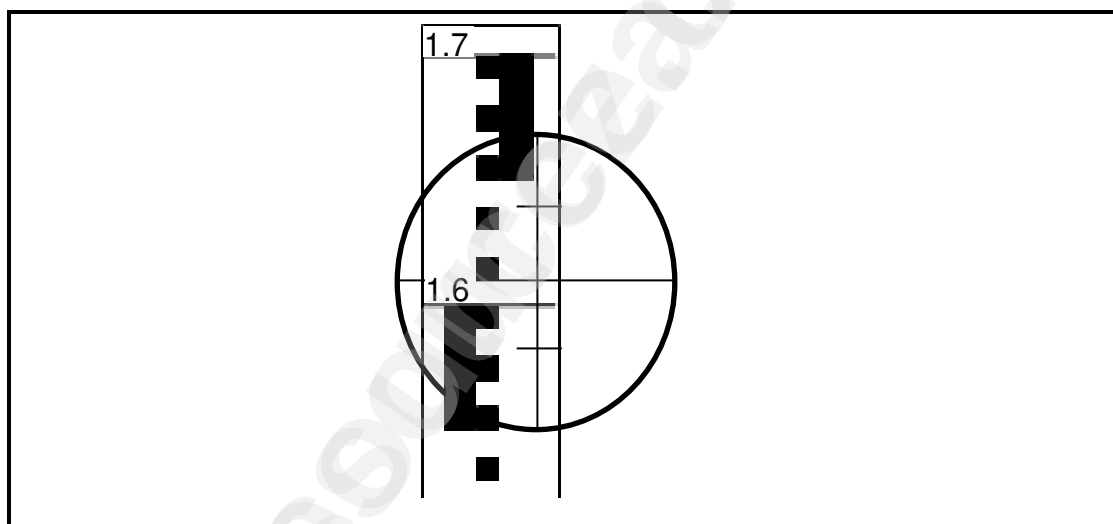


FIGURE 2.6

2.6.1 What is the height reading on the staff? (1)

2.6.2 Determine the distance between the dumpy level and the staff. Show ALL calculations, formulae and units. (4)

[40]

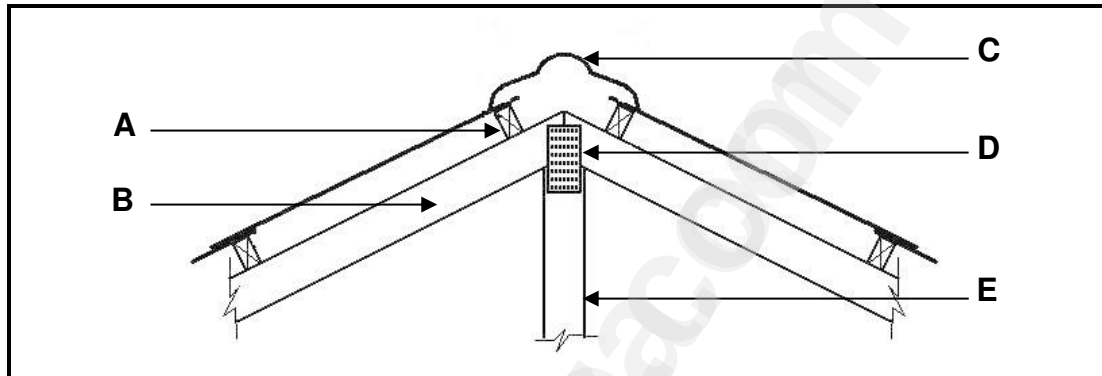
TOTAL SECTION A: 60

**QUESTION 3: ROOFS, STAIRCASES AND JOINING (SPECIFIC)**

Start this question on a NEW page

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- 3.1 Name THREE advantages for the use of roof underlays. (3 x 1) (3)
- 3.2 Name TWO requirements that roof trusses should meet. (2 x 1) (2)
- 3.3 Answer the following question with regard to roof construction in FIGURE 3.3.



**FIGURE 3.3**

- 3.3.1 Name parts **A** to **E**. (5 x 1) (5)
- 3.3.2 What are the measurements (sizes) of parts **B** and **E**? (2 x 1) (2)
- 3.3.3 What is the purpose (function) of part **D**? (1)
- 3.4 Choose the correct answer from the words given in brackets in the following statements:
- 3.4.1 The pitch of flat roofs are less than (10° / 20° / 30°). (1)
- 3.4.2 The maximum centre-to-centre spacing of battens are (245 mm / 345 mm / 445 mm). (1)
- 3.4.3 The minimum pitch for corrugated iron sheets are (5° / 10° / 15°). (1)
- 3.5 Provide the MEASUREMENT at the following descriptions of stairs:
- 3.5.1 The minimum depth of the tread. (1)
- 3.5.2 The maximum vertical increase of a staircase between landings. (1)
- 3.5.3 The maximum pitch of stairs for private use. (1)
- 3.5.4 The maximum rise of a stair. (1)

- 3.6 Provide ONE term for the following descriptions of staircases:
- 3.6.1 The horizontal distance covered by the stairs. (1)
  - 3.6.2 The overhang at the front of the tread. (1)
  - 3.6.3 The vertical member between two consecutive treads. (1)
- 3.7 Name TWO types of materials that staircases can be made from. (2 x 1) (2)
- 3.8 Identify the following statements as TRUE or FALSE:
- 3.8.1 The wall plate fixes the roof truss to the wall. (1)
  - 3.8.2 Galvanized steel straps must be to a depth of 600 mm in the wall for light roofs, if the wall is built from hollow concrete blocks. (1)
  - 3.8.3 Wall ties must be able to resist compressive stresses. (1)
- 3.9 Name TWO types of cast-in bolt anchors. (2 x 1) (2)
- [30]**

**QUESTION 4: MATERIAL, EQUIPMENT AND TOOLS, EXCAVATIONS AND FOUNDATIONS (SPECIFIC)**

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Start this question on a NEW page.

- 4.1 Choose a description from COLUMN B that fits best with the item in COLUMN A. Write only the letter (A–I) next to the question numbers (4.1.1 to 4.1.6) in the ANSWER BOOK, for example 4.1.7 K.

| COLUMN A |                   | COLUMN B |                        |
|----------|-------------------|----------|------------------------|
| 4.1.1    | Aluminium         | A        | heavy metal            |
| 4.1.2    | Silicone          | B        | dipped in molten zinc  |
| 4.1.3    | Ductile cast iron | C        | tested in a laboratory |
| 4.1.4    | Perspex           | D        | light metal            |
| 4.1.5    | Cube test         | E        | basic sealant          |
| 4.1.6    | Polystyrene       | F        | tested on the site     |
|          |                   | G        | packaging material     |
|          |                   | H        | alternative for glass  |
|          |                   | I        | highly toxic           |

(6 x 1) (6)

- 4.2 Name TWO methods to pump concrete to higher levels in a building. (2 x 1) (2)
- 4.3 What is the compressive strength in MPa of high-strength concrete? (1)
- 4.4 Name ONE disadvantage of ready-mix concrete. (1)
- 4.5 Name FOUR types of apparatus used for the slump test. (4 x 1) (4)
- 4.6 Discuss the purposes of the cube test. (2 x 1) (2)
- 4.7 How many cube samples is required for the cube test in a laboratory? (1)
- 4.8 Draw a neat sketch of a normal failure of the cube test in the ANSWER BOOK. (2)
- 4.9 Name the TWO main groups into which metals can be classified. (2 x 1) (2)
- 4.10 Name TWO types of material that can be used for the cladding of buildings. (2 x 1) (2)

- 4.11 Answer the following questions with regard to the construction machine in FIGURE 4.11.

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FIGURE 4.11

- 4.11.1 Is this machine used for light or heavy compaction of soil? (1)
- 4.11.2 Name TWO methods of maintaining the machine. (2 x 1) (2)
- 4.12 Identify the construction machines in FIGURES 4.12A and 4.12B. (2 x 1) (2)



FIGURE 4.12A

FIGURE 4.12B

- 4.13 Name TWO factors that can influence the design of a building and the excavation thereof. (2 x 1) (2)
- 4.14 Name FOUR causes for the collapse of an excavation. (4 x 1) (4)
- 4.15 Identify the following statements as TRUE or FALSE:
- 4.15.1 Red or orange warning lights are used excavations. (1)
- 4.15.2 The fencing around the perimeter of the excavation site must be at least two meters high. (1)
- 4.15.3 Ropes may be used to exit deep trenches. (1)
- 4.16 Name THREE types of foundations. (3 x 1) (3)

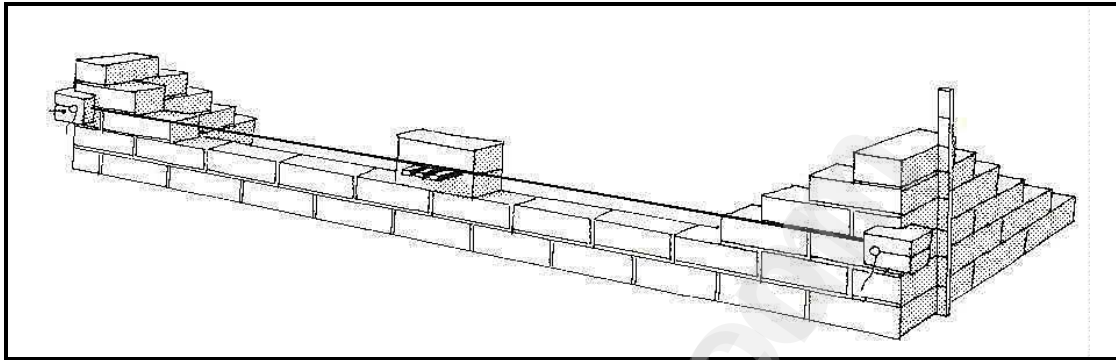
[40]

**QUESTION 5: BRICKWORK, GRAPHICS, PLASTER AND SCREED (SPECIFIC)**

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Start this question on a NEW page.

5.1 Answer the following questions with regard to the wall in FIGURE 5.1.



**FIGURE 5.1**

- 5.1.1 What type of bond was used to built this wall? (1)
- 5.1.2 Is this a half brick wall or a one brick wall? (1)
- 5.1.3 What is the width of the wall? (1)
- 5.2 Draw in the damp-proof course (DPC) at wall and floor on ANSWER SHEET B. (5 x 1) (5)
- 5.3 Answer the following questions with regard to the cavity wall.
- 5.3.1 What is the width of a standard cavity wall? (1)
- 5.3.2 How thick should the skins (leaves) at least be? (1)
- 5.3.3 What is the maximum height of a cavity wall? (1)
- 5.3.4 What connects the two skins? (1)
- 5.3.5 What is the purpose of the weep hole? (1)
- 5.4 Name THREE advantages of cavity walls. (3 x 1) (3)

- 5.5 Identify the wall ties in FIGURES 5.5A and 5.5B. (2 x 1) (2)

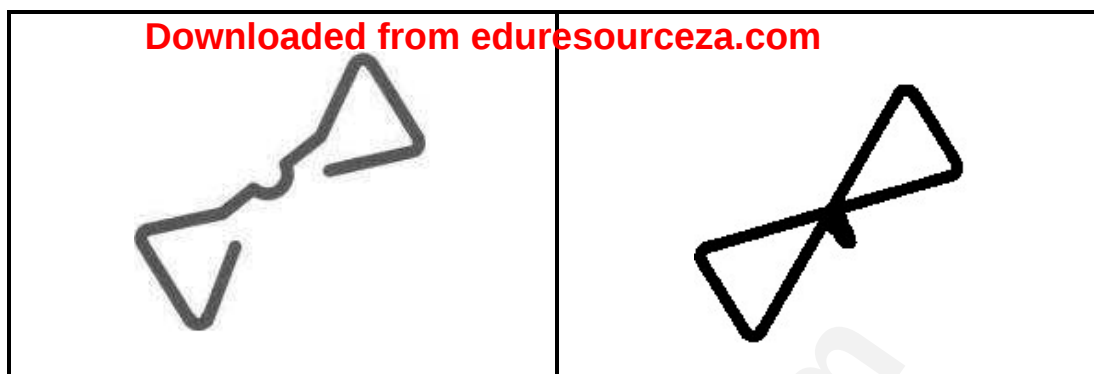


FIGURE 5.5A

FIGURE 5.5B

- 5.6 Choose a description from COLUMN B that fits best with the item in COLUMN A. Write only the letter (A–F) next to the question numbers (5.6.1 to 5.6.4) in the ANSWER BOOK, for example 5.6.5 G.

| COLUMN A           | COLUMN B                                         |
|--------------------|--------------------------------------------------|
| 5.6.1 Su-base      | A natural soil on which the paving will be laid  |
| 5.6.2 Kerb         | B sand used as grouting between paving blocks    |
| 5.6.3 Subgrade     | C best edge restraint for paving                 |
| 5.6.4 Bedding sand | D final layer upon which paving is laid          |
|                    | E preparation of the su-base                     |
|                    | F prepared layer beneath paving and bedding sand |

(4 x 1) (4)

- 5.7 Name TWO advantages of mortar-set paving. (2 x 1) (2)
- 5.8 Name TWO reasons for construction failure of paving. (2 x 1) (2)
- 5.9 Draw a neat sketch with EIGHT (8) bricks of the basket-weave paving pattern in the ANSWER BOOK. Use your own scale. (4)

5.10 Answer the following questions with regard to the arch in FIGURE 5.10.

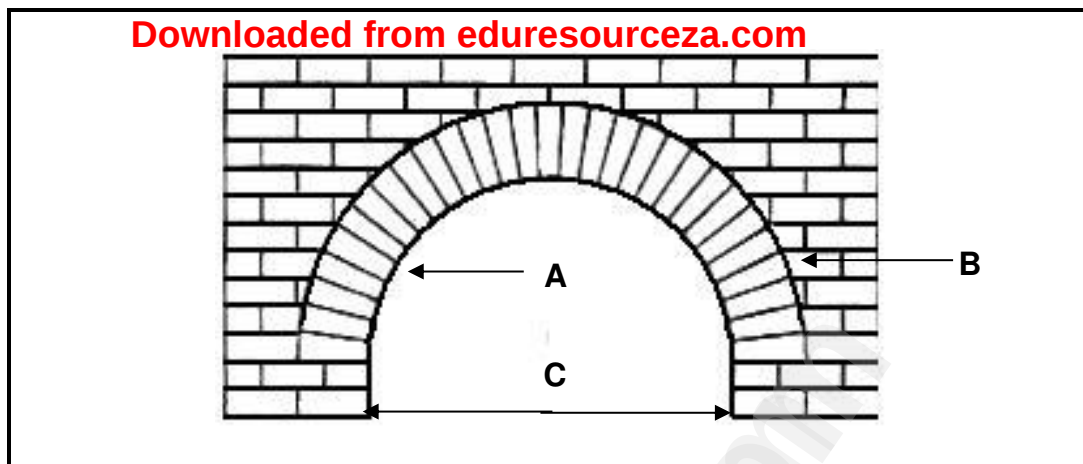


FIGURE 5.10

5.10.1 Identify this type of arch construction. (1)

5.10.2 Name parts **A** to **C**. (3 x 1) (3)

5.11 Name the ingredients of plaster (water and lime excluded). (2 x 1) (2)

5.12 Name TWO types of plaster finishes. (2 x 1) (2)

5.13 Name TWO types of screed layers. (2 x 1) (2)

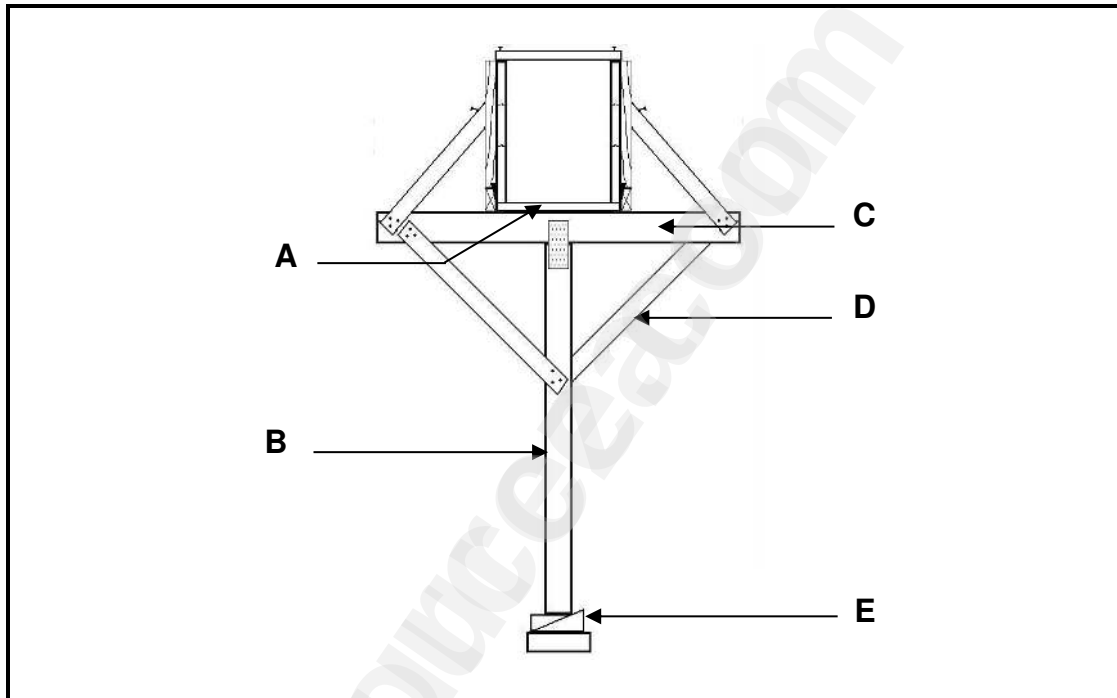
**[40]**

**QUESTION 6: FORMWORK, REINFORCING, CONCRETE FLOORS AND QUANTITIES (SPECIFIC)**

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Begin this question on a NEW page.

- 6.1 Define the term *in-situ concrete*. (1)
- 6.2 Name THREE properties of good formwork. (3 x 1) (3)
- 6.3 Answer the following questions with regard to the formwork in FIGURE 6.3.



**FIGURE 6.3**

- 6.3.1 Name parts **A** to **E**. (5 x 1) (5)
- 6.3.2 Is this formwork used for a column or a beam? (1)
- 6.4 Answer the following questions with regard to the bar code in FIGURE 6.4.

Bar code: **8Y12-01-200**

**FIGURE 6.4**

- 6.4.1 What type of steel is used? (1)
- 6.4.2 What is the diameter of the bars? (1)
- 6.4.3 What is the spacing of the bars? (1)

- 6.5 Draw a neat side view of the rib-and-block construction in the ANSWER BOOK. Show with an arrow the parts (rib and block). (6)

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- 6.6 Name ONE purpose of the cover depth at the reinforcing of concrete work. (1)

- 6.7 Name ONE method of joining steel bars. (1)

- 6.8 FIGURE 6.8 shows the outside measurements of a store-room.  
The foundation is 700 mm wide and 250 mm thick.  
Answer the following questions in the ANSWER BOOK.  
Table format is NOT required (show all formulas and steps).

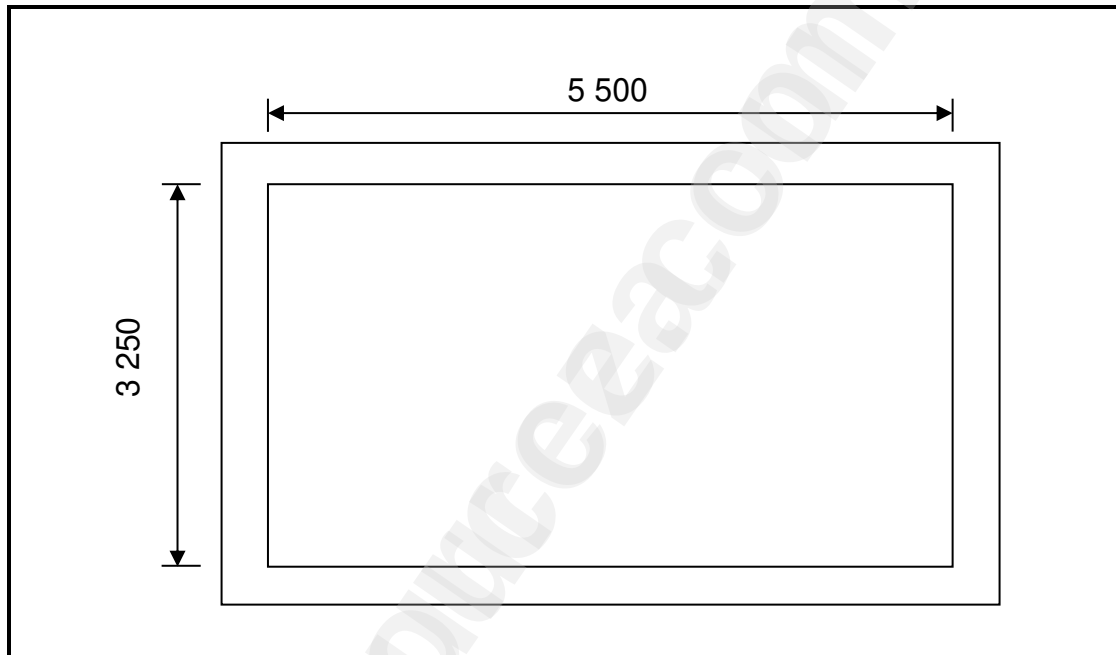


FIGURE 6.8

- 6.8.1 Calculate the centre line of the foundation. (5)

- 6.8.2 Calculate the volume of concrete required. (4)

[30]

TOTAL: 200

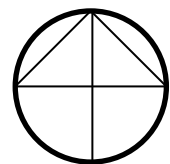
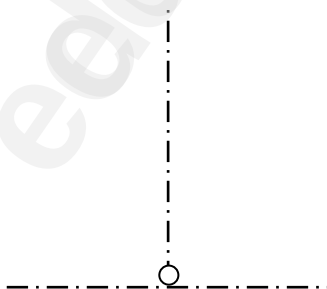
|                       |                             |             |
|-----------------------|-----------------------------|-------------|
| ANSWER SHEET <b>A</b> | CIVIL TECHNOLOGY<br>GENERIC | NAME: _____ |
|-----------------------|-----------------------------|-------------|

- 2.1 FIGURE 2.1 on ANSWER SHEET A shows the outer lines of a structure which must be built on a site. Draw the site plan on scale 1 : 200 on ANSWER SHEET A so that the structure is in the middle of the site.

(28)



|                        |           |  |
|------------------------|-----------|--|
| Plot size              | 2         |  |
| Pavement + street      | 3         |  |
| Building boundaries    | 4         |  |
| Entrance               | 2         |  |
| Datum level            | 2         |  |
| Water closet           | 1         |  |
| Sewer connection       | 2         |  |
| Inspection eye + abbr. | 2         |  |
| Rodding eye + abbr.    | 2         |  |
| Manhole + abbr.        | 2         |  |
| Measurements           | 6         |  |
| <b>TOTAL</b>           | <b>28</b> |  |



|                       |                                  |             |
|-----------------------|----------------------------------|-------------|
| ANSWER SHEET <b>B</b> | CIVIL TECHNOLOGY<br>CONSTRUCTION | NAME: _____ |
|-----------------------|----------------------------------|-------------|

5.2 Draw in the damp-proof course (DPC).

(5)

