



# basic education

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

## **NATIONAL SENIOR CERTIFICATE**

**GRADE 10**

**CIVIL TECHNOLOGY**

**EXEMPLAR 2016**

**MARKS: 200**

**TIME: 3 hours**

**This question paper consists of 21 pages, 5 answer sheets and 1 formula sheet.**

**REQUIREMENTS:**

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

**INSTRUCTIONS AND INFORMATION**

1. This question paper consists of FOUR sections: SECTIONS A, B, C and D.
2. SECTION A (QUESTIONS 1, 2, 3, and 4) is COMPULSORY for all learners.
3. Choose ONE of the following SECTIONS according to the area of specialisation that you have registered for:

SECTION B (QUESTIONS 5 and 6) – Construction

SECTION C (QUESTIONS 7 and 8) – Civil Services

SECTION D (QUESTIONS 9 and 10) – Woodworking

**NOTE:** If you answer the questions in SECTIONS B, C and D that you have NOT registered for, they will NOT be marked.

4. Number the answers correctly according to the numbering system used in this question paper.
5. Start the answer to EACH question on a NEW page.
6. Do NOT write in the margin of the ANSWER BOOK.
7. You may use sketches to illustrate your answers.
8. Write ALL calculations and answers in the ANSWER BOOK or on the attached ANSWER SHEETS. Answers to calculations should be rounded off to TWO decimal places. Show the units of ALL answers.
9. Use the mark allocation as a guide to the length of your answers.
10. 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*.
11. For the purpose of this question paper, the size of a brick should be taken as 220 mm x 110 mm x 75 mm.
12. Use your own discretion where dimensions and/or details have been omitted.
13. All dimensions are in millimetres, unless stated otherwise.
14. Answer QUESTIONS on the attached ANSWER SHEETS, as prescribed in each question where applicable.
15. Drawings in the question paper are NOT to scale due to electronic transfer.

**SECTION A: GENERICS (COMPULSORY)****QUESTION 1: SAFETY**

1.1 FIGURE 1.1 below shows a worker and a visitor on a construction site.



**FIGURE 1.1**

- 1.1.1 What safety equipment can the visitor use to prevent falling objects from injuring him? (1)
- 1.1.2 Explain TWO safety measures that must be implemented to ensure the safety of visitors and workers on a site. (2)
- 1.1.3 Identify ONE unsafe act that the worker is performing. (1)
- 1.2 You are working with electrical cutting tools on a site. Name any TWO types of safety equipment that you may use to protect yourself against injuries. (2)
- 1.3 Describe TWO safety precautions that have to be considered when working with hand tools. (2)
- 1.4 Name THREE elements that must be present in a fire for it to be able to burn. (3)
- 1.5 Explain THREE factors that must be considered when stacking material in a workshop. (3)
- 1.6 Predict THREE consequences of the behaviour of a worker on a building site when the worker is intoxicated because of alcohol or drug abuse. (3)
- 1.7 Describe THREE visible symptoms that a worker is under the influence of drugs. (3)

**[20]**

**QUESTION 2: MATERIALS, TOOLS AND EQUIPMENT**

Start this question on a NEW page.

- 2.1 Choose a description from COLUMN B that matches an item in COLUMN A. Write only the letter (A–L) next to the question number (2.1.1–2.1.10) in the ANSWER BOOK, for example 2.1.11 M.

| COLUMN A |                             | COLUMN B |   |
|----------|-----------------------------|----------|---|
| 2.1.1    | Concrete                    | A        | not brittle due to heat treatment                 |
| 2.1.2    | Saligna                     | B        | can be cast in any shape/mould                    |
| 2.1.3    | Amount of water in concrete | C        | made up of an uneven number of layers of veneer   |
| 2.1.4    | SA pine                     | D        | light-weight metal                                |
| 2.1.5    | Cement                      | E        | this material is baked                            |
| 2.1.6    | Copper                      | F        | will influence the workability of fresh concrete  |
| 2.1.7    | Plywood                     | G        | bonding ingredient in concrete, mortar and screed |
| 2.1.8    | Aluminium                   | H        | soft wood   |
| 2.1.9    | Clay bricks                 | I        | good conductor of heat                            |
| 2.1.10   | Malleable cast iron         | J        | hardwood  |
|          |                             | K        | available in even layers                          |
|          |                             | L        | curing is required for 60 days                    |

(10 x 1) (10)

- 2.2 Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (2.2.1–2.2.10) in the ANSWER BOOK, for example 2.2.11 C.

2.2.1 ... may be used for formwork.

- A Block board
- B Plywood
- C Shutter board
- D All the above-mentioned

(1)

- 2.2.2 ... can be soft-soldered, silver-soldered and brazed.
- A Bronze
  - B Copper
  - C Lead
  - D Zinc
- (1)
- 2.2.3 ... form(s) waterproof joints because it repels water.
- A PVC adhesives
  - B Mortar
  - C Silicon
  - D Wood glue
- (1)
- 2.2.4 A ... is the tool recommended for mixing concrete and mortar.
- A pick
  - B round shovel
  - C square shovel
  - D spade
- (1)
- 2.2.5 A ... is used for measuring when laying out buildings.
- A steel tape
  - B folding rule
  - C steel square
  - D line and pins
- (1)
- 2.2.6 A ... is used by a plasterer to place plaster in difficult corners.
- A mastic trowel
  - B long jointer
  - C short jointer
  - D pointing trowel
- (1)
- 2.2.7 A ... may be used to cut copper pipes neatly and accurately.
- A tenon saw
  - B hacksaw
  - C pipe cutter
  - D grinder
- (1)
- 2.2.8 A/An ... may be used to clamp galvanised pipes when they are being cut to size.
- A pipe wrench
  - B adjustable spanner
  - C pipe vice
  - D pipe cutter
- (1)

2.2.9 A ... may be used to level fresh concrete.

- A spirit level
- B steel square
- C long jointer
- D straight edge





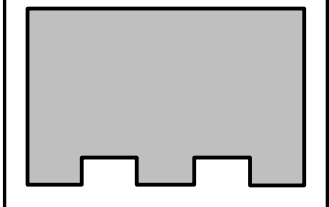
(1)

2.2.10 A ... may be used to tap joints into place.

- A brick trowel
- B wooden mallet
- C mortise chisel
- D plumb bob

(1)

2.3 The table below shows pictures of hand tools that are used on sites and in workshops. Write down the NAME and ONE use of EACH tool next to the question numbers (2.3.1–2.3.5) in the ANSWER BOOK.

|   |   |  |
|---|---|--|
|   |   |  |
| 2.3.1   | 2.3.2   | 2.3.3  |
|  |  |  |
| 2.3.4   | 2.3.5   |  |

(10)

2.4 Describe TWO properties of EACH of the following materials:

2.4.1 Sand (2)

2.4.2 Stainless steel (2)

2.4.3 Mastic sealant (2)

2.5 Discuss TWO properties of PVC adhesives. (2)

2.6 Differentiate between a *steel square* and a *try square* in terms of use. (2)

**[40]**

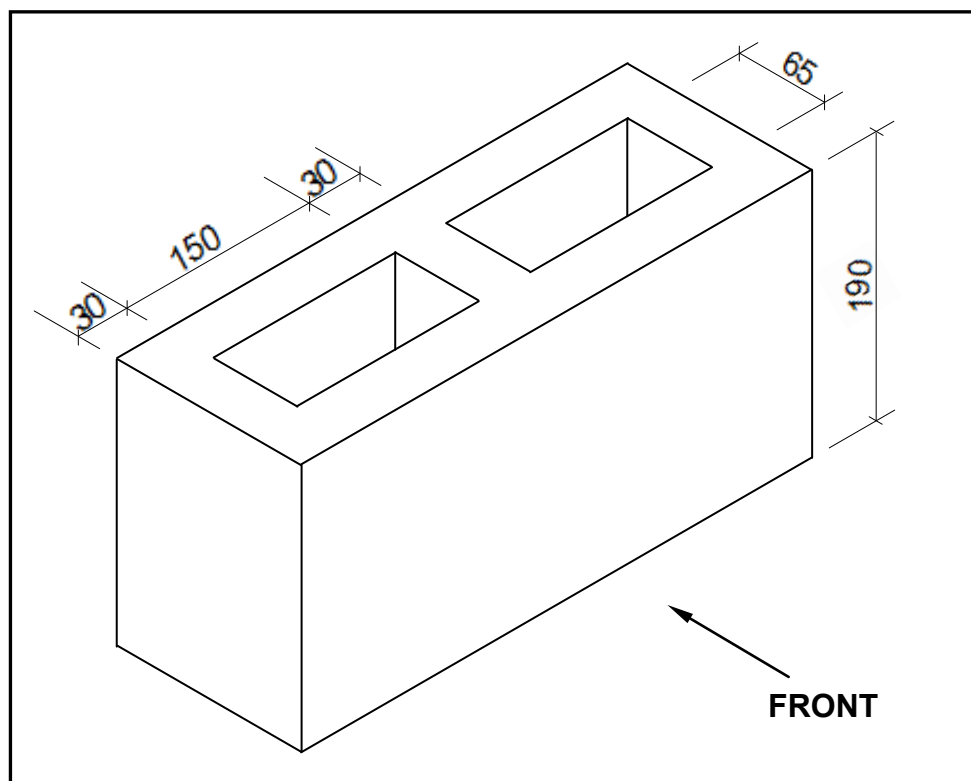
**QUESTION 3: GRAPHICS AS MEANS OF COMMUNICATION**

Start this question on a NEW page.

- 3.1 Define the term *CAD*, as used in drawing. (1)
- 3.2 Draw a neat, freehand, isometric sketch of a standard solid brick, in good proportion, in the ANSWER BOOK. (5)
- 3.3 FIGURE 3.3 shows an isometric view of a cement hollow block. Use ANSWER SHEET 3.3 and draw, to scale 1 : 5, the front, left and top views of this cement hollow block in first-angle orthographic projection. The thickness of the concrete around the hollow is 30 mm all around.

Show the following in the drawing:

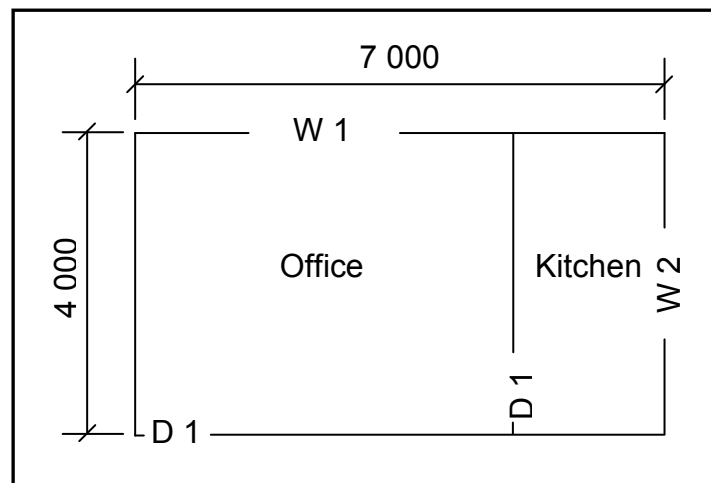
- ALL hidden detail
- Construction lines
- Dimensions for the height and length of the block
- Print the title and the scale below the drawing.



**FIGURE 3.3**

(17)

3.4 FIGURE 3.4 shows the line diagram of a plan of an office with a kitchen.



**FIGURE 3.4**

On ANSWER SHEET 3.4 develop and draw, to scale 1 : 50, the floor plan of the office and kitchen. Use the specifications given below.

Specifications:

- The external measurements of the building are 7 000 mm x 4 000 mm.
- The internal width of the kitchen is 2 000 mm.
- External walls are 220 mm thick.
- Internal wall is 110 mm thick.
- All door openings are 900 mm wide.
- The external door is placed 500 mm from the left side of the building, measured from the outside of the wall.
- The internal door is placed 230 mm from the inside of the external wall.
- Window 1 is 2 000 mm wide and is placed in the middle of the office wall.
- Window 2 is 1 500 mm wide and is placed in the middle of the kitchen wall.

(15)

Indicate the internal dimensions of the kitchen.

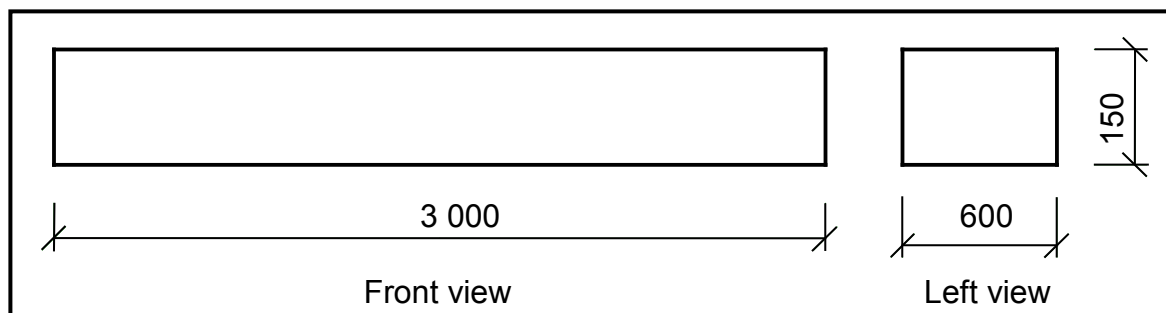
(2)  
**[40]**



**QUESTION 4: JOINING AND QUANTITIES**

Start this question on a NEW page.

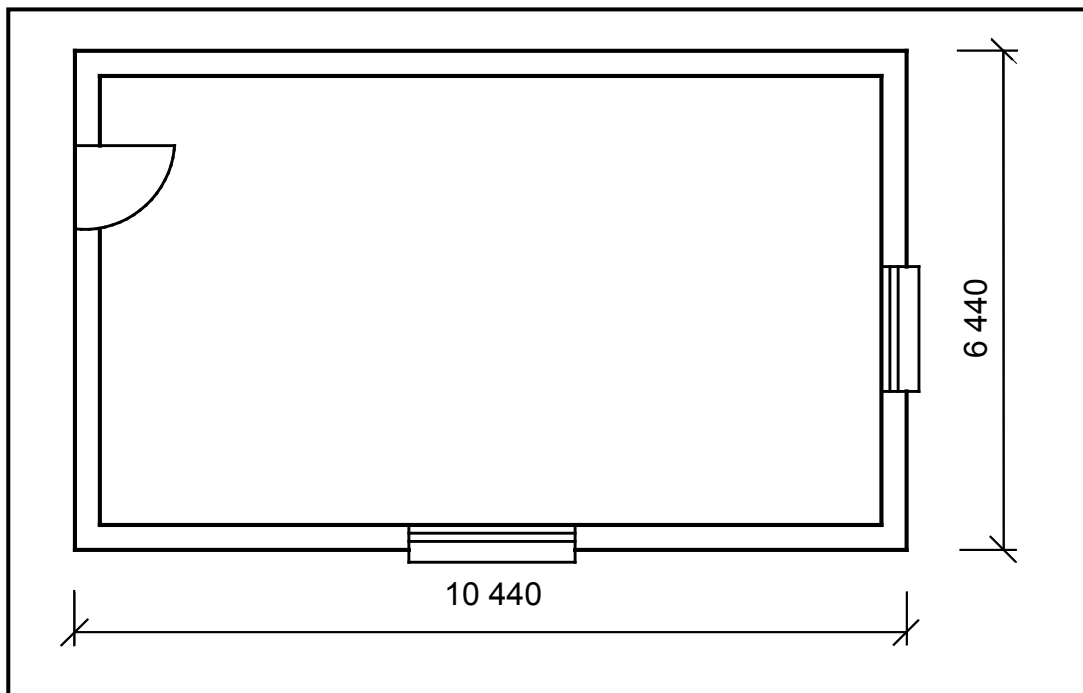
- 4.1 Explain THREE advantages of using nails over screws. (3)
- 4.2 Explain THREE advantages of using screws over nails. (3)
- 4.3 Indicate where the following fasteners may be used:
- 4.3.1 Countersunk head screw (1)
- 4.3.2 Drywall screw (1)
- 4.3.3 Round wire nail (1)
- 4.3.4 Panel pin (1)
- 4.4 FIGURE 4.4 below shows the front and left views of a straight foundation.



**FIGURE 4.4**

- 4.4.1 Determine the length of the concrete foundation in metres. (1)
- 4.4.2 Determine the width of the concrete foundation in metres. (1)
- 4.4.3 Determine the depth of the concrete foundation in metres. (1)
- 4.4.4 Calculate the volume of concrete required for this foundation. Round off your answer to ONE decimal. (5)

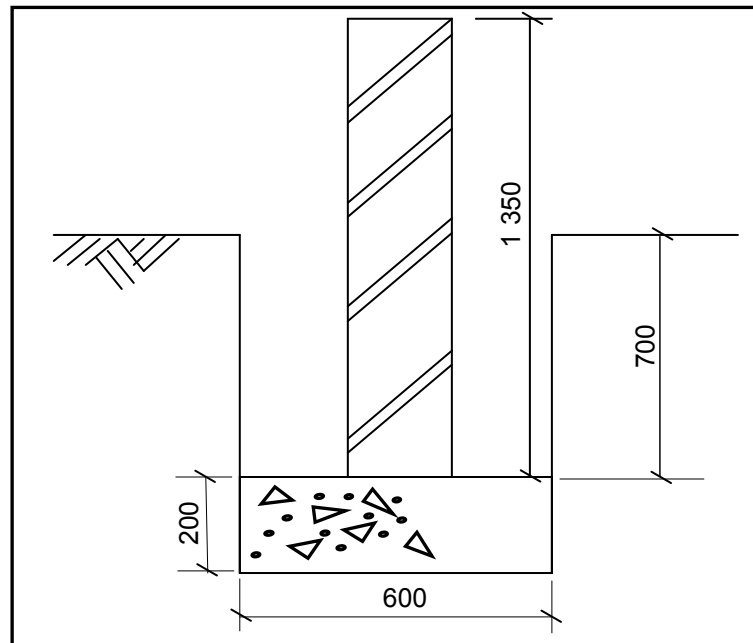
- 4.5 FIGURE 4.5 below shows the floor plan of a building. Study the sketch and answer the following questions.



**FIGURE 4.5**

- 4.5.1 Calculate the length of the skirting for the building if the door opening is 900 mm wide. Ignore the reveals at the door opening. (9)
- 4.5.2 Calculate the area of the floor. (4)

- 4.6 FIGURE 4.6 below shows a foundation trench of 8 metres in length that has been excavated and cast with concrete.



**FIGURE 4.6**

- 4.6.1 Calculate the volume of soil that has been excavated from the trench. (5)
- 4.6.2 Calculate the area of the wall if the wall stops 150 mm from the edge of the foundation on both sides. (4)
- [40]**

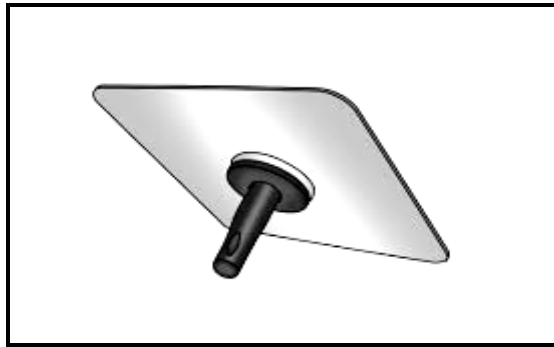
**TOTAL SECTION A: 140**

**SECTION B: CONSTRUCTION****QUESTION 5: FOUNDATIONS, CONCRETE AND BRICKWORK**

Start this question on a NEW page.

5.1 Identify the tools illustrated in FIGURE 5.1.1 and FIGURE 5.1.2 below.

5.1.1

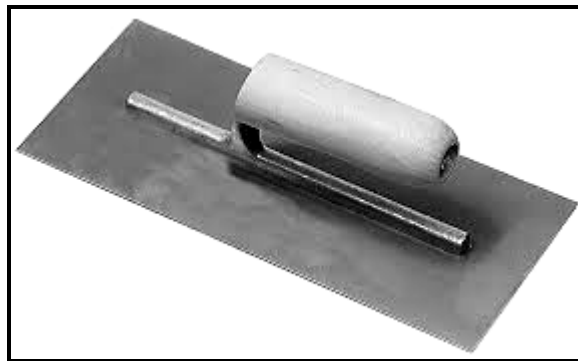


[Source: Google Images]

**FIGURE 5.1.1**

(1)

5.1.2



[Source: Google Images]

**FIGURE 5.1.2**

(1)

5.2 Describe the meaning of the safety sign illustrated in FIGURE 5.2 below.



**FIGURE 5.2**

(1)

5.3 Explain TWO uses of a block brush. (2)

5.4 Explain THREE reasons for compacting soil during a construction process. (3)

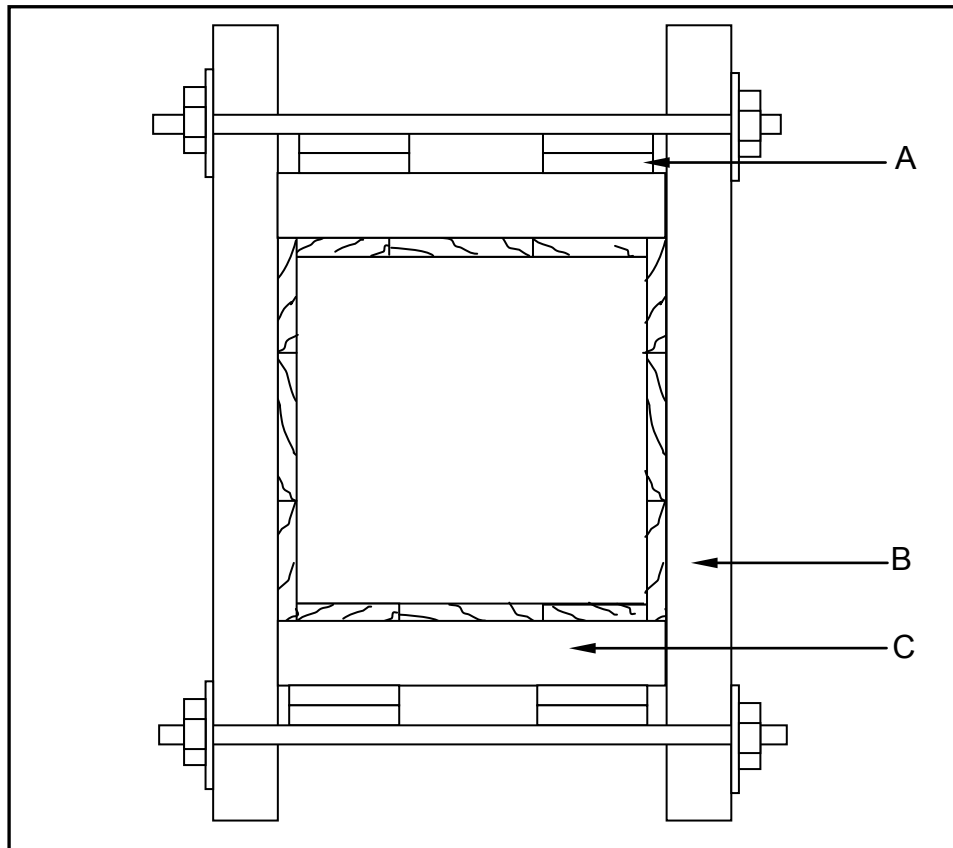
5.5 Explain the purpose of foundations. (2)

- 5.6 Differentiate between a *strip foundation* and a *stepped foundation* by means of neat, two-dimensional freehand sketches in the ANSWER BOOK. (4)
- 5.7 The foundation of a building need to be cast in phases. Draw a freehand drawing in the ANSWER BOOK to show an exploded view of how fresh concrete should be joined to the existing concrete to ensure a good bond between the two. (4)
- 5.8 When damage is detected in a concrete structure, this damage must be evaluated and repaired. Describe, in the correct sequence, the steps that should be followed to remedy the situation. (4)
- 5.9 Explain the purpose of reinforcing brickwork. (2)
- 5.10 Name any TWO methods of tying reinforcement bars together. (2)
- 5.11 Concrete with a volume of  $5 \text{ m}^3$  and a mixing ratio of 1 : 3 : 6 (1 part cement, 3 parts sand and 6 parts stone) needs to be mixed by hand. Calculate the volume of sand that will be required for this batch of concrete. (4)
- HINT:** Use the formulae in the formulae sheet. [30]

**QUESTION 6: FORMWORK**

Start this question on a NEW page.

- 6.1 Name ONE type of nail that may be used to join the different members of formwork. (1)
- 6.2 FIGURE 6.2 below shows the horizontal cross section of the formwork for a concrete column. Name the parts labelled **A**, **B** and **C**. Write only the answer next to the letter (A–C) in the ANSWER BOOK.

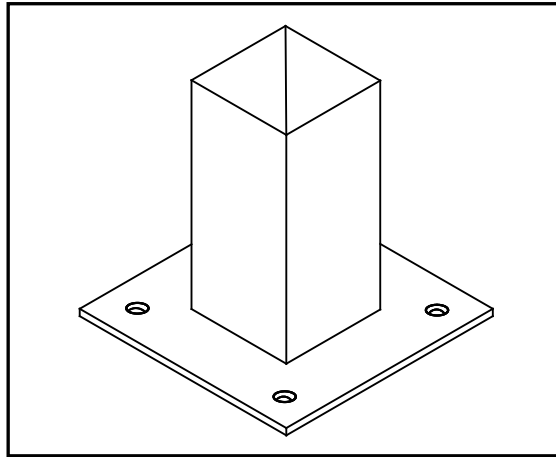


**FIGURE 6.2**

- 6.3 Explain what is meant by the term *striking of formwork*. (1)
- 6.4 Describe TWO factors that must be considered while striking of formwork is taking place. (2)
- 6.5 Plywood may be used for formwork. Describe THREE properties of plywood. (3)
- 6.6 Draw a neat, two-dimensional freehand sketch, in good proportion, in the ANSWER BOOK to illustrate the front elevation of a soldier course, as used in brickwork. Show only SIX bricks. (3)
- 6.7 Use ANSWER SHEET 6.7 and draw, to scale 1 : 10, the front elevation of a brick wall built in stretcher bond to show raking back on the right-hand side of the wall and toothing on the left-hand side of the wall. The first course of the wall is five bricks long and the wall is five courses high. Label the drawing to indicate the raking back and the toothing. (10)

6.8 Draw the symbol for concrete. (2)

6.9 FIGURE 6.9 below shows a baseplate that has to be anchored to a concrete base. Name TWO fasteners that may be used to secure the baseplate to the concrete base.



**FIGURE 6.9**

6.10 Name ONE fastener that may be used to join wood to concrete. (1)

6.11 Describe TWO methods to store radioactive material. (2)  
[30]

**TOTAL SECTION B: 60**

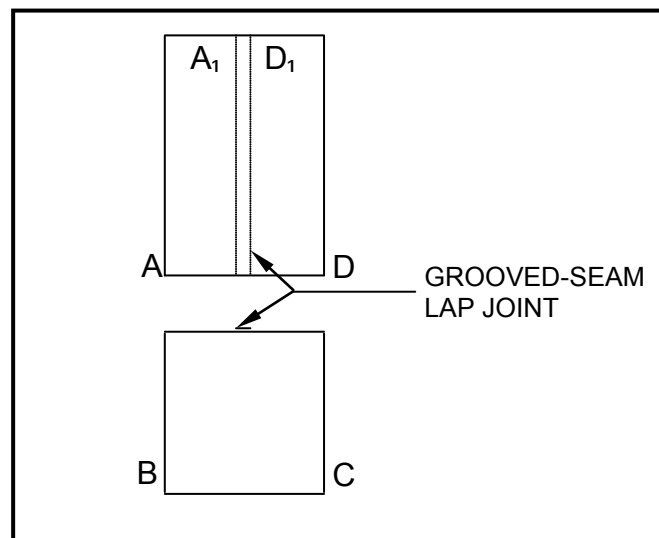
**SECTION C: CIVIL SERVICES****QUESTION 7: CONSTRUCTION, STORM WATER AND ROOF WORK**

Start this question on a NEW page.

- 7.1 Explain THREE good lifting techniques that should be applied when lifting heavy loads manually. (3)
- 7.2 On what geometrical theorem is the 3-4-5 method based? (1)
- 7.3 In your ANSWER BOOK, draw a freehand sketch of TWO consecutive plan courses of a half-brick wall in stretcher bond. Show SIX bricks for the first course. (4)
- 7.4 Describe THREE factors that may lead to workers being injured when they work in deep excavations. (3)
- 7.5 State the ingredients of mortar. (3)
- 7.6 Differentiate between *class 0* and *class 2 copper pipes* in terms of wall thickness and use. Copy the table below in the ANSWER BOOK and complete it. (4)

| TYPE    | WALL THICKNESS | USE |
|---------|----------------|-----|
| Class 0 |                |     |
| Class 2 |                |     |

- 7.7 FIGURE 7.7 below shows a front and a top view of a square down pipe with a grooved-seam lap joint. On ANSWER SHEET 7.7, project and draw, from the given views, the development of the square down pipe plus the allowance for the seam. (8)

**FIGURE 7.7**

- 7.8 Large amounts of storm water on a site must be disposed of. Describe TWO methods that may be used to channel the storm water to the catchment areas. (2)
- 7.9 You have to install a gutter onto a roof. Explain, in your own words, the factors that will determine the slope (fall) and direction of the exit of the water in the gutter. (2)

**[30]**



**QUESTION 8: HOT- AND COLD-WATER SUPPLY AND SANITARY FITMENTS**

Start this question on a NEW page.

- 8.1 Name TWO properties of clean water. (2)
- 8.2 Explain the water cycle in your own words. (4)
- 8.3 Differentiate between *water obtained from wells* and *water obtained from boreholes* in terms of the disadvantages of each. (2)
- 8.4 Describe TWO methods that may be used to prevent water pipes from freezing. (2)
- 8.5 Explain TWO purposes of EACH of the following valves:
- 8.5.1 Pressure-reducing (pressure-control) valve (2)
- 8.5.2 Safety valve (2)
- 8.6 Explain the term *radiation*. (2)
- 8.7 Differentiate between a *balanced water installation* and an *unbalanced water installation* for a house. (2)
- 8.8 FIGURE 8.8 below shows a sanitary fitment.

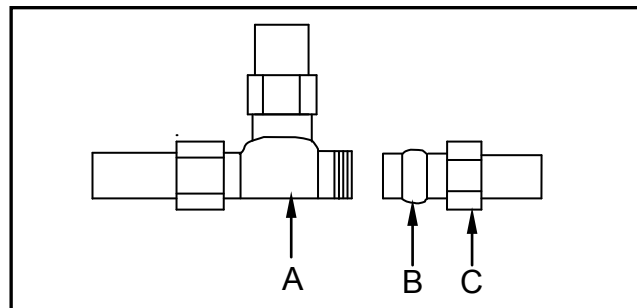


[Source: Google Images]

**FIGURE 8.8**

- 8.8.1 Identify the sanitary fitment above. (1)
- 8.8.2 Draw the symbol for the sanitary fitment in FIGURE 8.8, as it will appear on a floor plan. (2)

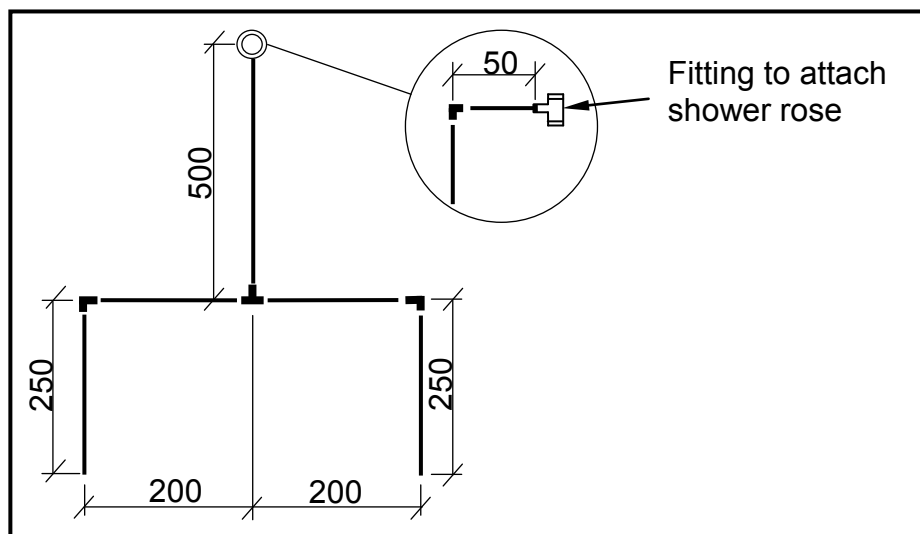
- 8.9 FIGURE 8.9 below shows a drawing of the exploded view of a compression joint. Identify parts **A**, **B** and **C**.

**FIGURE 8.9**

(3)

- 8.10 Make a neat freehand drawing, in good proportion, of the sectional view of a grooved-seam lap joint. (2)

- 8.11 FIGURE 8.11 below shows a line diagram of part of the pipe layout of a shower. Calculate the total length of pipe and the number of fittings needed for the installation of this shower by completing the quantity list below FIGURE 8.11. Write down only the answer next to the question number (8.11.1–8.11.4) in the ANSWER BOOK.

**FIGURE 8.11**

| MATERIAL            | DESCRIPTION                       | QUANTITY | LENGTH        |
|---------------------|-----------------------------------|----------|---------------|
| Copper              | 8.11.1                            | 3        |               |
| Copper              | 8.11.2                            | 1        |               |
| Brass               | Ø15 mm straight connector, female | 1        |               |
| Copper              | Ø15 mm class 0 pipe               | 1        | 500           |
| Copper              | Ø15 mm class 0 pipe               | 8.11.3   | 250           |
| Copper              | Ø15 mm class 0 pipe               | 2        | 200           |
| Copper              | Ø15 mm class 0 pipe               | 1        | 50            |
| <b>Total length</b> |                                   |          | <b>8.11.4</b> |

(4)  
[30]**TOTAL SECTION C: 60**

**SECTION D: WOODWORKING****QUESTION 9: CASEMENTS**

Start this question on a NEW page.

9.1 Draw a horizontal section through a tree trunk to show the following parts:

- Pith/Core/Heart
- Heart wood
- Sapwood
- Annual rings
- Medullary rays
- Bark
- Cambium layer

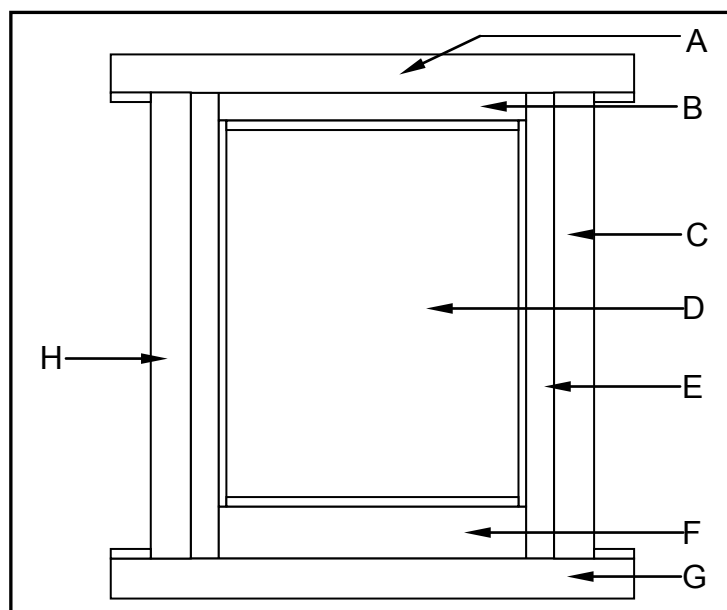
Label any THREE parts of the drawing. (10)

9.2 Differentiate between a *dead knot* and a *live knot*. (2)

9.3 Explain ONE use of a mortice gauge. (1)

9.4 Explain the purpose of the cross peen in a Warrington hammer. (1)

9.5 FIGURE 9.5 below shows a drawing of the external elevation of a single casement within a frame. Study the drawing and answer the questions that follow.



**FIGURE 9.5**

9.5.1 Identify parts **A** to **G**. (7)

9.5.2 Name the component that may be used to keep **D** in place. (1)

9.5.3 Use instruments and draw, in good proportion, a horizontal section through part **H** in the ANSWER BOOK. (5)

9.6 Explain THREE purposes of a rebate in a frame. (3)

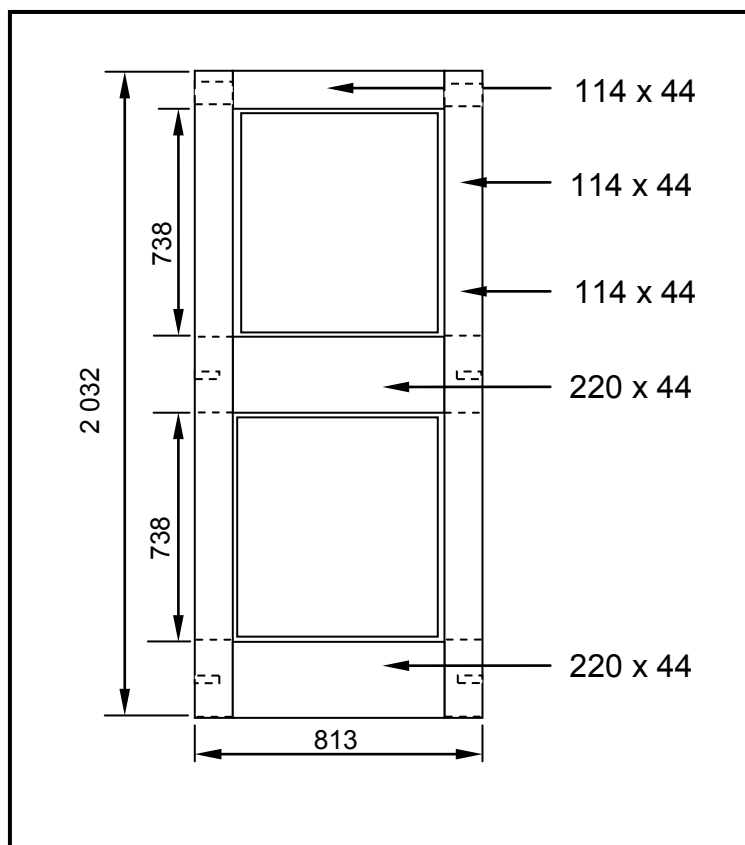
**[30]**

**QUESTION 10: DOORS**

Start this question on a NEW page.

- 10.1 Predict ONE negative consequence of poor housekeeping. (1)
- 10.2 Name TWO materials that may be used as a panel for a hollow flush panel door. (2)
- 10.3 You are going to hang a hollow flush panel door. The door is longer than the height of the opening. Name the type of hand saw that you will use to cut the door to fit into the opening of the door frame. (1)
- 10.4 Name ONE type of glue that may be used to join members of a hollow flush panel door. (1)
- 10.5 Explain ONE property of glue that makes it suitable to use for the assembling of external doors. (1)
- 10.6 FIGURE 10.6 below shows the front elevation of a two-panel door. The door is fitted with flat 10 mm thick plywood panels which are embedded 10 mm into the stiles and rails. Study the drawing and complete the cutting list on the next page (page 21) by writing down only the answer next to the question number (10.6.1–10.6.9) in the ANSWER BOOK. Through mortice and tenon joints are used between the rails and the stiles.

**NOTE:** Show actual sizes in your answer.



**FIGURE 10.6**

| MEMBER/<br>DESCRIPTION | QUANTITY/<br>NUMBER<br>REQUIRED | LENGTH        | WIDTH         | THICKNESS     | MATERIAL      |
|------------------------|---------------------------------|---------------|---------------|---------------|---------------|
| Stiles                 | <b>10.6.1</b>                   | 2 030         | <b>10.6.2</b> | 44            | Meranti       |
| Top rail               | 1                               | <b>10.6.3</b> | 114           | <b>10.6.4</b> | Meranti       |
| <b>10.6.5</b>          | 1                               | 813           | <b>10.6.6</b> | 44            | <b>10.6.7</b> |
| Bottom rail            | <b>10.6.8</b>                   | 813           | 220           | 44            | Meranti       |
| Panels                 | 2                               | 758           | <b>10.6.9</b> | 10            | Plywood       |

(9)

10.7 Use drawing instruments and draw a neat, two-dimensional drawing to show how the tongued and grooved battens are joined to the ledge in a ledged batten door. Show part of the ledge and only TWO tongued and grooved battens in your drawing.

(5)

10.8 Use ANSWER SHEET 10.8 and draw, to scale 1 : 10, the internal elevation of a ledged batten door to the following specifications:

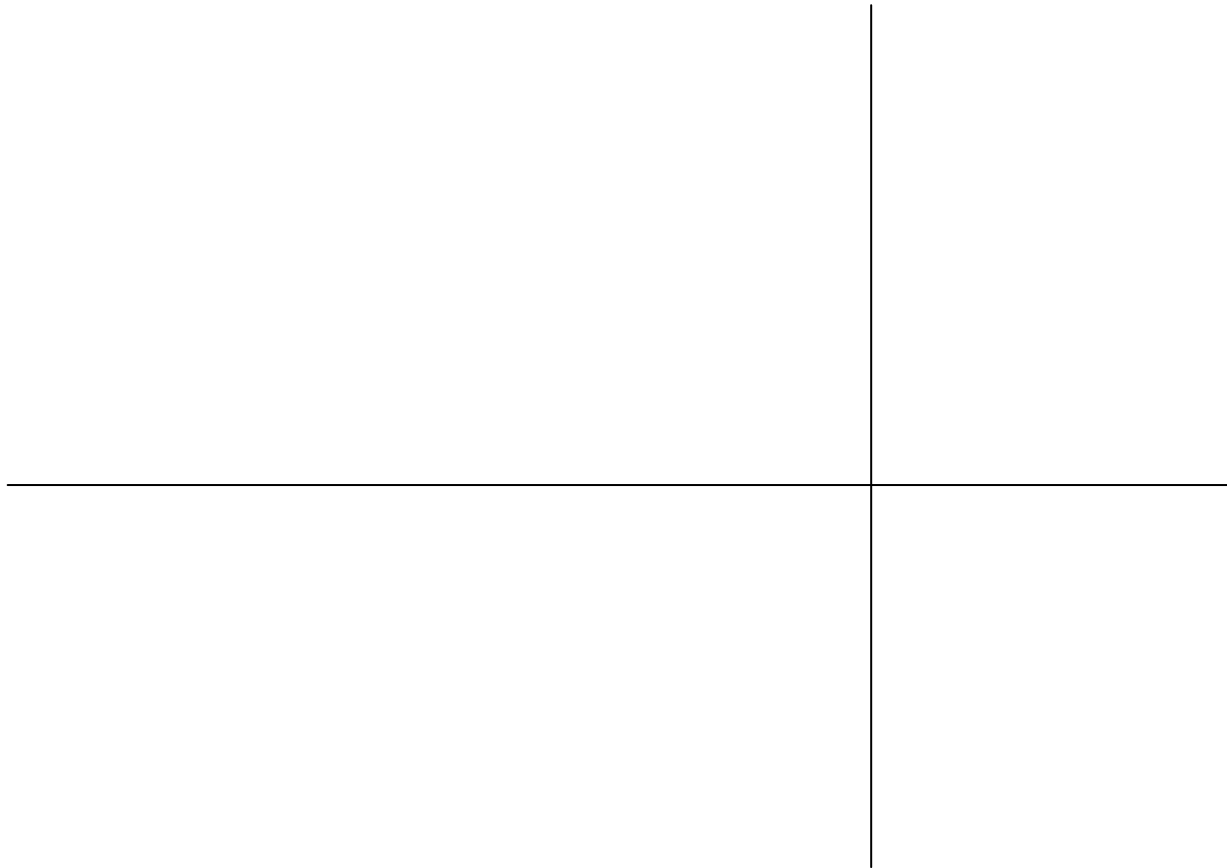
- Size of door: height is 2 032 mm and the width is 813 mm
- Tongued and grooved battens: 100 mm x 22 mm
- Ledge: 150 mm x 22 mm
- The top and bottom ledges are 150 mm away from the top and bottom of the door.
- Label any THREE parts of the door.

(10)  
[30]

**TOTAL SECTION D: 60**  
**GRAND TOTAL: 200**

**SECTION A: ANSWER SHEETS**

|                          |  |
|--------------------------|--|
| <b>SURNAME AND NAME:</b> |  |
| <b>CLASS:</b>            |  |

**SECTION A: ANSWER SHEET 3.3**

| CRITERIA                  | MARK      | LM |
|---------------------------|-----------|----|
| Drawing of external lines | 7         |    |
| Hidden detail             | 6         |    |
| Printing of title         | 1         |    |
| Printing of scale         | 1         |    |
| Application of scale      | 2         |    |
| <b>TOTAL</b>              | <b>17</b> |    |

|                          |  |
|--------------------------|--|
| <b>SURNAME AND NAME:</b> |  |
| <b>CLASS:</b>            |  |

**SECTION A: ANSWER SHEET 3.4**

| CRITERIA                               | MARK      | LM |
|--|-----------|----|
| External walls drawn correctly         | 4         |    |
| Internal wall drawn correctly          | 1         |    |
| Doors drawn correctly                  | 2         |    |
| Windows drawn correctly                | 2         |    |
| Correct placement of doors             | 2         |    |
| Correct placement of windows           | 2         |    |
| Dimension of internal width of kitchen | 2         |    |
| Application of scale                   | 2         |    |
| <b>TOTAL</b>                           | <b>17</b> |    |

**SECTION B: ANSWER SHEETS**

|                          |  |
|--------------------------|--|
| <b>SURNAME AND NAME:</b> |  |
| <b>CLASS:</b>            |  |

**SECTION B: ANSWER SHEET 6.7**

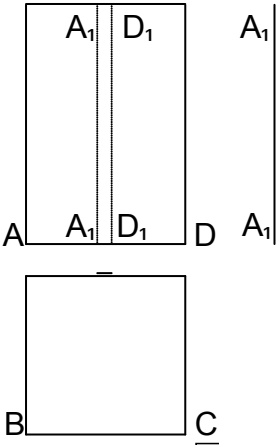
| CRITERIA               | MARK      | LM |
|------------------------|-----------|----|
| Correctness of drawing | 6         |    |
| Labelling              | 2         |    |
| Application of scale   | 2         |    |
| <b>TOTAL</b>           | <b>10</b> |    |



SECTION C: ANSWER SHEETS

|                   |  |
|-------------------|--|
| SURNAME AND NAME: |  |
| CLASS:            |  |

SECTION C: ANSWER SHEET 7.7



**SECTION D: ANSWER SHEETS**

|                          |  |
|--------------------------|--|
| <b>SURNAME AND NAME:</b> |  |
| <b>CLASS:</b>            |  |

**SECTION D: ANSWER SHEET 10.8**

**FORMULA SHEET**

| AREA OF                                     | FORMULA<br>(in words)         | FORMULA<br>(In symbols) |
|---|-------------------------------|-------------------------|
| Square                                      | side x side                   | s x s                   |
| Rectangle                                   | length x breadth              | l x b                   |
| Right-angled triangle                       | $\frac{1}{2}$ x base x height | $\frac{1}{2}b \times h$ |
| Equilateral triangle/<br>Isosceles triangle | $\frac{1}{2}$ x base x height | $\frac{1}{2}b \times h$ |

**Calculation of volumes of materials for concrete**

Volume of material = Volume of concrete required x  $\frac{\text{Mix ratio of material}}{\text{Total mix ratio}}$