higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

BUILDING SCIENCE N2

(15070012)

24 November 2023 (X-paper)
09:00–12:00

Drawing instruments and nonprogrammable calculators may be used.

This question paper consists of 4 pages, 2 diagram sheets and a formula sheet.

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
BUILDING SCIENCE N2
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer all the questions.
2. Read all the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. All sketches and diagrams must be done in pencil.
5. Assume that 1 kg of mass exerts a force 10 N.
6. Round off to THREE decimal places.
7. Write down the formula before you start your calculations.
8. Write neatly and legibly.

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QUESTION 1

1.1 Name any FIVE sources of heat. (5)

1.2 Name FOUR types of thermometers, instruments used to accurately measure temperature. (4)

1.3 Explain, with the aid of a neat sketch and labels, a suitable experiment to prove that metals expand in length when they are heated. (8)

[17]

QUESTION 2

The beam shown in FIGURE 1 (DIAGRAM SHEET 1 attached), is held at equilibrium by the reactions R_L and R_R.

2.1 Calculate the magnitude of support R_L by taking moments about R_R. (5)

2.2 Calculate the magnitude of support R_R by taking moments about R_L. (5)

2.3 Test your answer by considering the sum of the upward forces and the sum of the downward forces. (3)

[13]

QUESTION 3

3.1 Define the term *relative density* of a material (Specific gravity). (3 × 1) (3)

3.2 Name THREE absorbent and THREE non-absorbent materials. (3 × 2) (6)

3.3 Explain porosity concerning burnt-clay bricks. (3)

3.4 Explain capillarity concerning voids in a burnt-clay brick. (3)

3.5 Name TWO properties for each of the following roof coverings:

3.5.1 Malthoid bitumen

3.5.2 Clay tiles

(2 × 2) (4)

[19]

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QUESTION 4

A piece of metal plate of even thickness is shown in FIGURE 2 (DIAGRAM SHEET 1, attached). The compound section is symmetrical about the X axis. All measurements are in millimetres.

4.1 Calculate the total area of the compound section. (6)

4.2 Determine the distance of the centroid of each section from B–B. (4)

4.3 Calculate the sum of the moments of the section from B–B. (6)

4.4 Calculate the position of the centroid of the compound section from B–B. (4)

[20]

QUESTION 5

FIGURE 3 (DIAGRAM SHEET 2 attached) shows a simple supported roof truss with two supports R_L and R_R.

Use the following scale: A Linear scale 1 m = 10 mm and a Force scale of 1 mm = 1 kN.

5.1 Redraw the space diagram and complete the Bow's notation. (4)

5.2 Complete the vector diagram required to analyse the forces in the members. (7)

5.3 Determine the magnitude and nature of the forces in each member of the frame and tabulate the findings neatly. (9)

[20]

QUESTION 6

The system of coplanar, concurrent forces shown in FIGURE 4 (DIAGRAM SHEET 2 attached) is held in equilibrium by Force 'Q'.

Use the following scales: A linear scale 1 m = 10 mm and a Force scale of 1 mm = 1 kN.

6.1 Redraw the space diagram and complete a Bow's Notation. (3)

6.2 Determine by graphical means the magnitude and direction of force 'Q'.

NOTE: (No marks will be given for any calculations) (8)

[11]

TOTAL: 100

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DIAGRAM SHEET 1

QUESTION 2

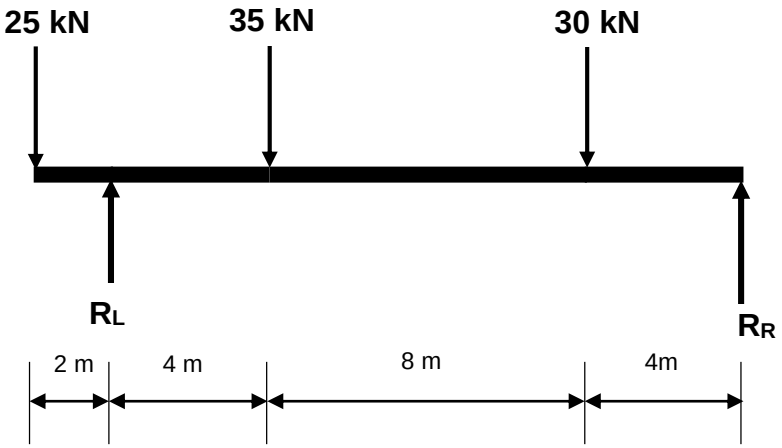


FIGURE 1

QUESTION 4

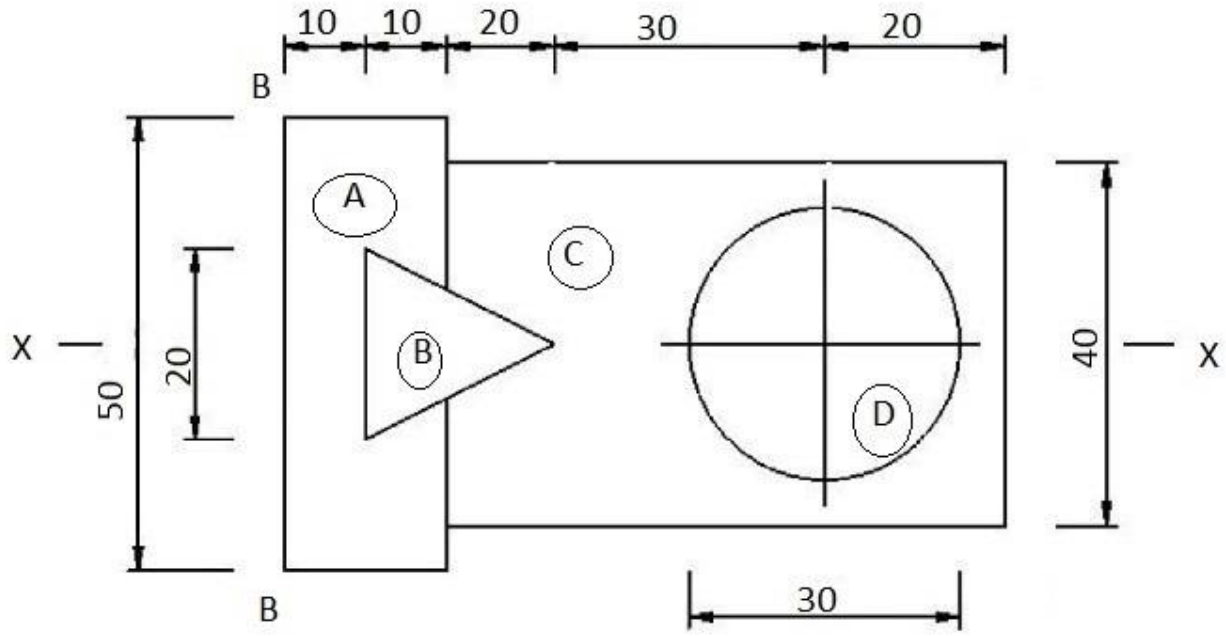


FIGURE 2

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DIAGRAM SHEET 2

QUESTION 5

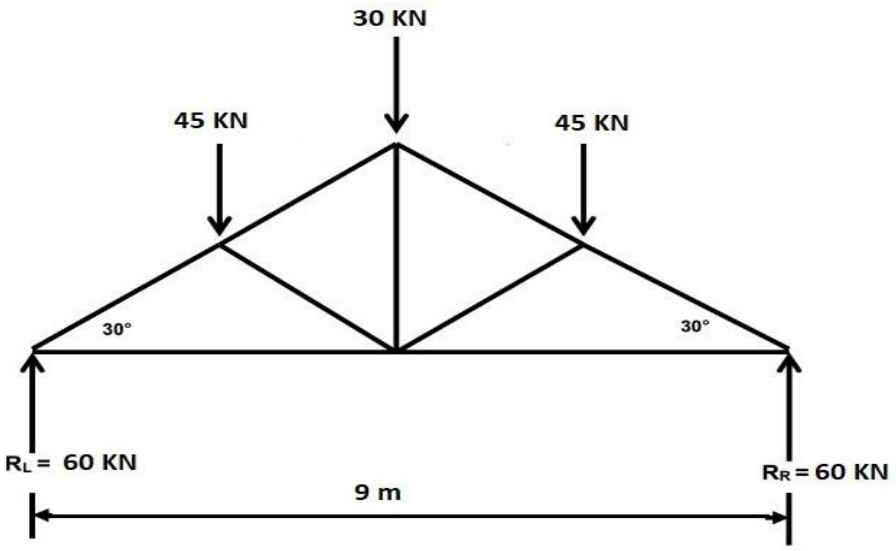


FIGURE 3

QUESTION 6

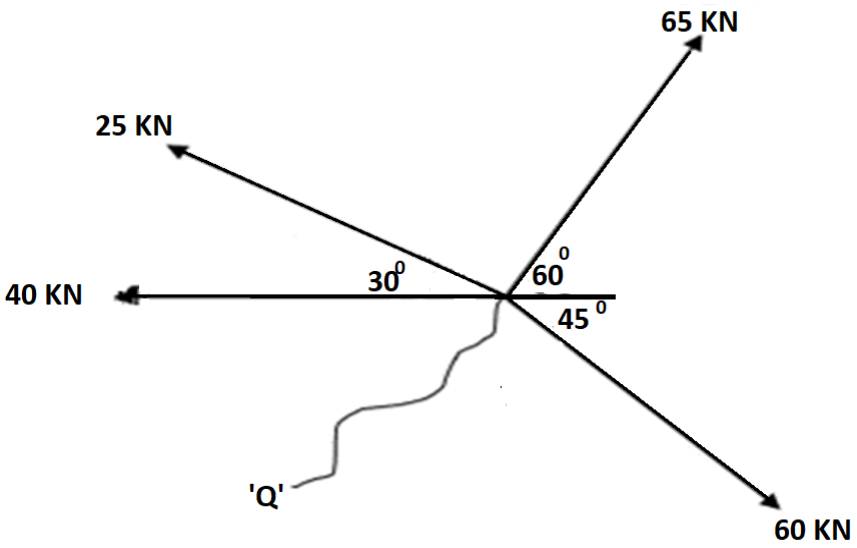


FIGURE 4

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BUILDING SCIENCE N2

FORMULA SHEET

Any applicable formula may be used.

1. F = m x g
2. Sin ø = O/H Sinø = T/S
3. Cos ø = A/H Cosø = A/S
4. Tan ø = O/A Tanø = T/A
5. $A = \pi\frac{D^2}{4}$ = π r²
6. A = ½(B x H) A = ½(L x B)
7. $V = \pi\frac{D^2}{4}x\ H$
8. ∑ CM = ∑ ACM
9. ∑ ↑F = ∑ ↓F
10. V = L x B x H
11. M = F x s
12. K = C + 273
13. Moment of area = area x distance from axis
14. VC = W. Sin ø VK = W. Sin ø
15. HC = W. Cos ø HK = W. Cos ø
16. $y = \frac{\sum My}{\sum A}$
17. $D = \frac{M}{V}$
18. $RD = \frac{DxS}{DxW}$ = $RD = \frac{MxS}{MxW}$
19. $\Delta L = Lo\ x\ \Delta T\ x\ \alpha$
20. Heat required = $m\ x\ \Delta t\ x\ SHC$
21. $\%\ porosity = \frac{Bulk\ volume - Solid\ volume}{Bulk\ volume}\ x\ 100\%$
22. $saturation\ coefficiant = \frac{volume\ of\ water\ absorbed}{bulk\ volume - solid\ volume}$

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