higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

BUILDING SCIENCE N2

(15070012)

8 April 2021 (X-paper)
09:00–12:00

Nonprogrammable calculators may be used.

This question paper consists of 4 pages, 2 diagram sheets and 1 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 of 10 N.
6. Round off final answers to THREE decimal places.
7. Write down the formula before starting the calculations.
8. Write neatly and legibly.

QUESTION 1

1.1 Define the following terms:

1.1.1 Joule

1.1.2 Heat capacity

1.1.3 Specific heat capacity

(3 × 3) (9)

1.2 Convert 35 °C to kelvin. (3)

1.3 A quantity of 385 kJ of heat energy is added to 45 kg of copper with a specific heat capacity of 0,394 kJ/kg°C. The original temperature of the copper was recorded as 14 °C.

Calculate the final temperature of the copper. (5)

[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. Ignore UDL.

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 taking the sum of the upward forces and the sum of the downward forces into account. (3)

[13]

QUESTION 3

3.1 Name THREE absorbent and three non-absorbent of building materials. (3 × 2) (6)

3.2 Explain the difference between *capillarity* and *porosity* in relation to burnt clay bricks. (5)

3.3 Calculate the saturation coefficient of a material when the volume of pores is 1,045 cm^3 and the volume of water is 1,031 cm^3. (3)

3.4 List FIVE types of roof covering materials. (5)

[19]

QUESTION 4

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

4.1.1 Calculate the total area of the compound section. (4)

4.1.2 Determine the distance of the centroid of each section from 'X–X'. (3)

4.1.3 Calculate the sum of the moments of the section about 'X–X'. (5)

4.1.4 Calculate the position of the centroid of the compound section from 'X–X'. (4)

4.2 Explain the difference between a *centroid* and a *couple*. (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: Linear scale 1 m = 10 mm and Force scale 1 mm = 1 kN.

5.1 Redraw the space diagram in your ANSWER BOOK. (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 scale: Linear scale 1 m = 10 mm and Force scale 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

DIAGRAM SHEET 1

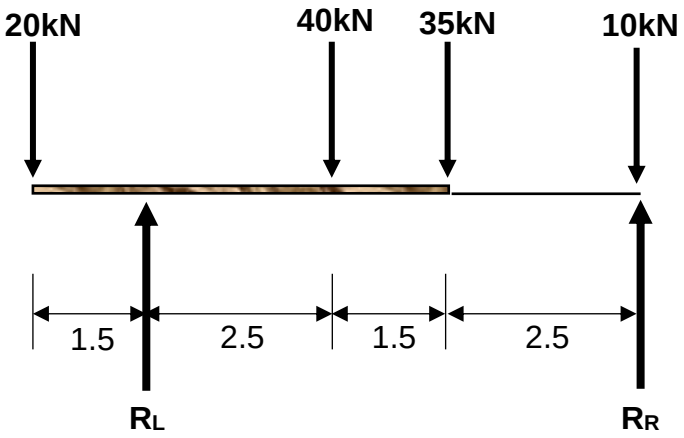

FIGURE 1

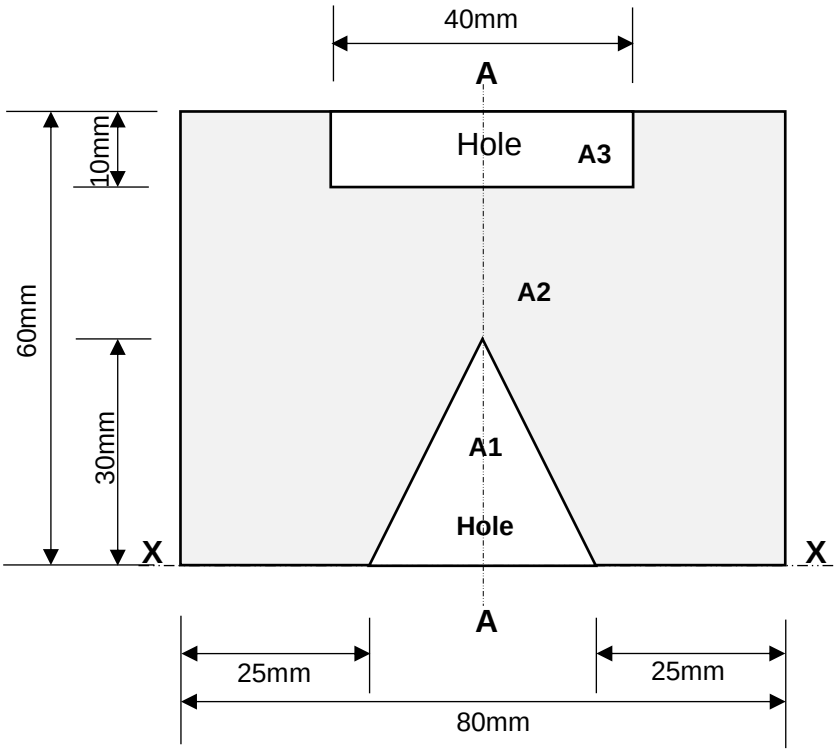

FIGURE 2

DIAGRAM SHEET 2

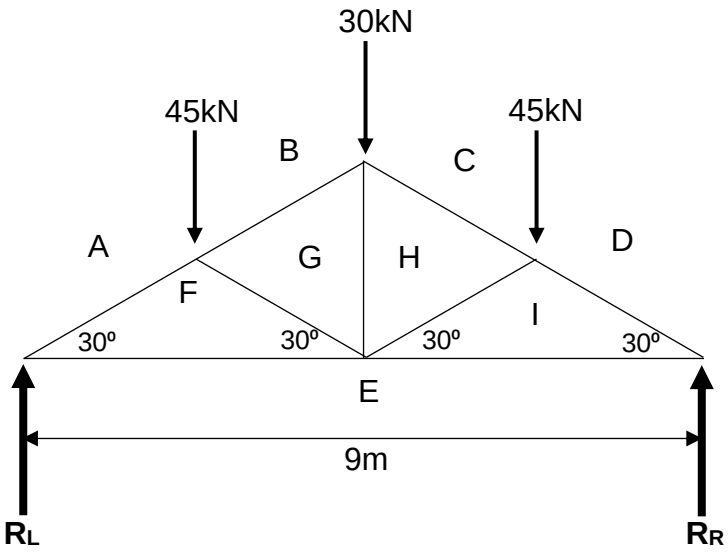

FIGURE 3

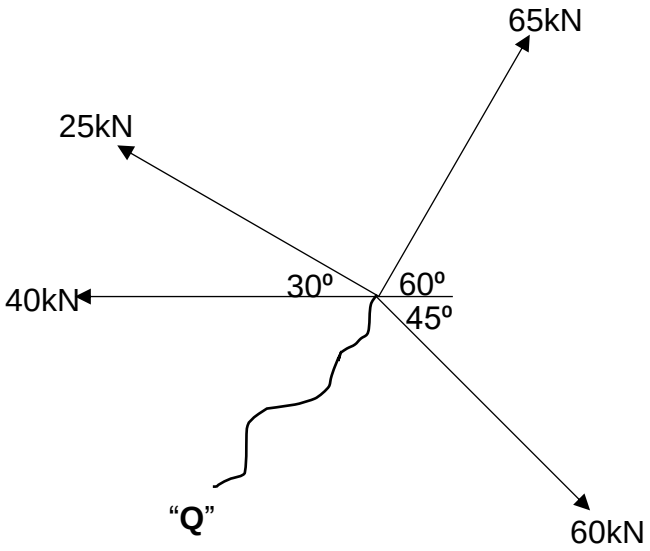

FIGURE 4

BUILDING SCIENCE N2

FORMULA SHEET

Any applicable formula may be used.

1. F =m x g
2. Sin ø = O/H Sin ø = T/S
3. Cos ø = A/H Cos ø = A/S
4. Tan ø = O/A Tan ø = 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. $saturation\ coefficiant = \frac{volume\ of\ water\ absorbed}{bulk\ volume - solid\ volume}$