higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

BUILDING SCIENCE N2

(15070012)

3 April 2020 (X-paper)
09:00–12:00

Drawing instruments and calculators may be used.

This question paper consists of 5 pages, 2 diagram sheets and 1 formula sheet.

078Q1A2003

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. Write down the formula before you start your calculations.
7. Write neatly and legibly.

QUESTION 1

1.1 Name FIVE sources of heat. (5)

1.2 Define the following terms:

1.2.1 Specific heat capacity

1.2.2 Heat capacity

(2 × 3) (6)

1.3 Name THREE changes which can be brought about when a material is heated. (3)

1.4 A material is 235 cm long and its length increased to 235,33 cm after the temperature has increased by 120 °C.

Calculate the coefficient of linear expansion of material. (5)

[19]

QUESTION 2

A piece of metal plate of even thickness is shown in FIGURE 1 on DIAGRAM SHEET 1 (attached). The compound section is symmetrical about M-M. All measurements are in millimetres.

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

2.2 Determine the distance of the centroid of each section from 'Y-Y'. (3)

2.3 Calculate the sum of the moments of the section about 'Y-Y'. (5)

2.4 Calculate the position of the centroid of the compound section from 'Y-Y'. (4)

[16]

QUESTION 3

The beam shown in FIGURE 2 on DIAGRAM SHEET 1 (attached) is held in equilibrium by the reactions R_L and R_R.

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

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

3.3 Test your answer by taking into account the sum of the upward forces and the sum of the downward forces. (3)

[13]

QUESTION 4

The system of coplanar, concurrent forces shown in FIGURE 3 on DIAGRAM SHEET 2 (attached) is held in equilibrium by force 'M'.

Use the following scale: Linear scale 1 m = 10 mm and a force scale of 1 mm = 2 kN.

4.1 Redraw the space diagram and complete a Bow's notation. (3)

4.2 Determine by graphical means, the magnitude and direction of force 'M'.

NOTE: No marks will be given for any calculations. (9)

[12]

QUESTION 5

FIGURE 4 on DIAGRAM SHEET 2 (attached) shows a pin-jointed frame in equilibrium.
Use the following scale: Linear scale 1 m = 10 mm and a force scale of 1 mm = 1 kN.

5.1 Redraw the space diagram. (2)

5.2 Complete the vector diagram required to analyse the forces in the members. (13)

5.3 Determine the magnitude and nature of the forces in each member of the frame and tabulate the findings neatly. (20 × ½) (10)

[25]

QUESTION 6

6.1 If a brick is placed in a container full of water and tiny bubbles come to the surface, you can know that the brick is porous.

State whether the following statement are TRUE of FALSE by only writing 'True' or 'False' next to the question number (6.1.1–6.1.4) in the ANSWER BOOK. Correct the statement if it is FALSE.

6.1.1 Bricks are baked and during this process heat absorbs the moisture in.

6.1.2 The bubbles are caused by water penetrating the pores in the brick and displaying the air inside the pores.

6.1.3 Timber can become porous, as shrinking wood cells leave vacuums when the sap in them dries out.

6.1.4 The density of a material where the voids are taken into account is called bulk density.

(6)

6.2 Calculate the volume of the pores of material using the following information:

Saturation coefficient = 0,78
Volume of water absorbed = 0,032 cm^3 (4)

6.3 Calculate the brick porosity percentage (%), if the volume of the brick is 5,7 cm^3. After the brick has been crushed, the absolute volume of the powder is 4,5 cm^3. (5)
[15]

TOTAL: 100

DIAGRAM SHEET 1

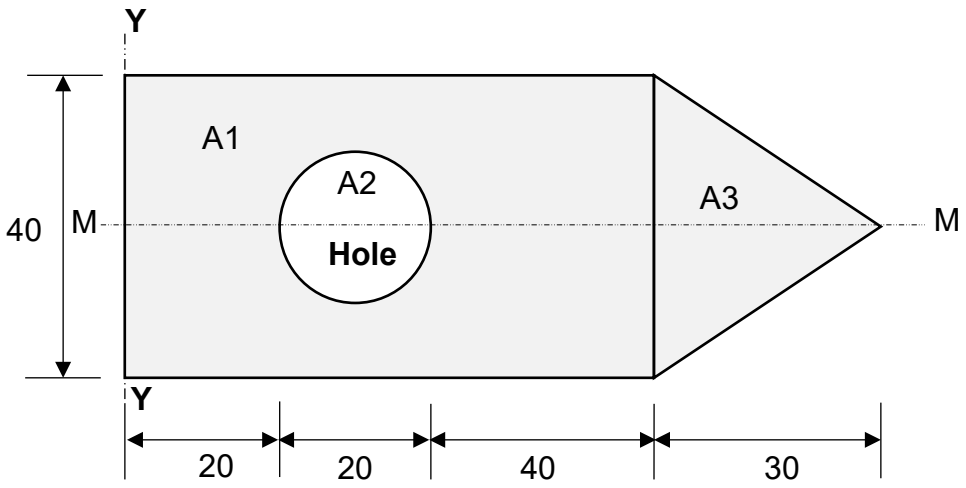

FIGURE 1

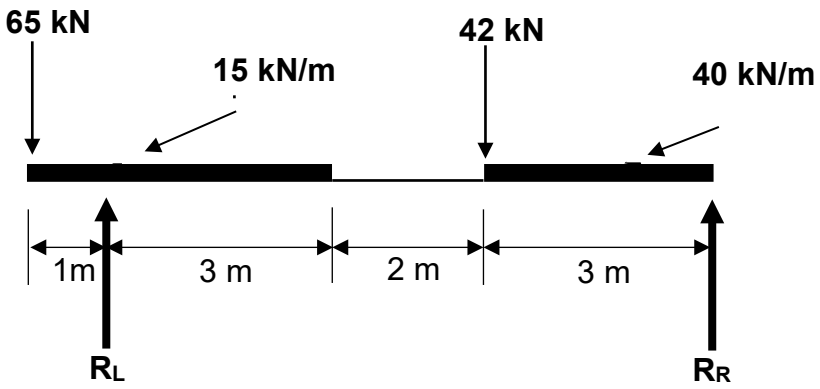

FIGURE 2

DIAGRAM SHEET 2

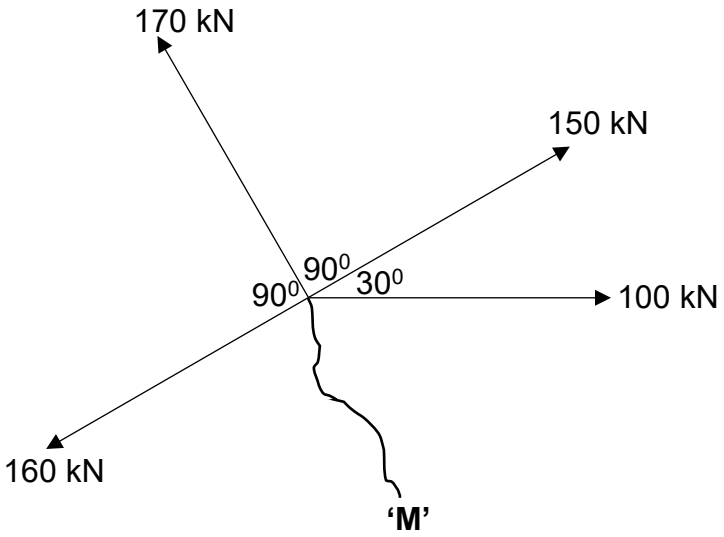

FIGURE 3

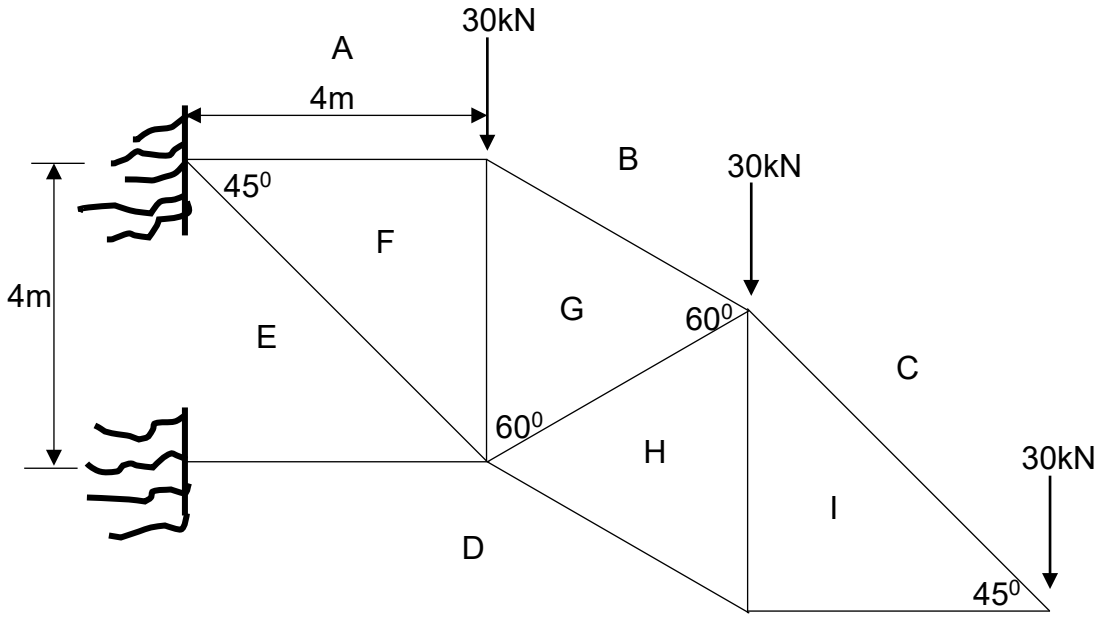

FIGURE 4

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. $saturation\ coefficiant = \frac{volume\ of\ water\ absorbed}{bulk\ volume - solid\ volume}$