higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T240**(E)**(A2)T

NATIONAL CERTIFICATE

BUILDING SCIENCE N2

(15070012)

2 April 2019 (X-Paper)
09:00–12:00

Calculators may be used.

This question paper consists of 4 pages, 2 diagram sheets and 1 formula sheet.

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. Sketches must be large, neat and fully labelled.
5. ALL drawings must be done in pencil.
6. ALL the drawings must be drawn to the required scale.
7. Write neatly and legibly.

QUESTION 1

Define the following terms:

1.1 Law of moments

1.2 Archimedes principle of floatation

1.3 Resultant force

1.4 The centroid

1.5 Cantilever

(5 × 3) **[15]**

QUESTION 2

The beam shown in FIGURE 1 on 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 taking into account the sum of the upward forces and the sum of the downward forces. (3)

[13]

QUESTION 3

3.1 The lever arm in FIGURE 2 on DIAGRAM SHEET 1 (attached) is held in equilibrium by upwards forces with a turning point at the pivot.

3.1.1 Calculate the magnitude of force Q. (4)

3.1.2 Draw the vector diagram to determine the magnitude of the resultant force to scale 1 kN = 1 mm. (6)

3.2 3.2.1 Name TWO absorbent building materials. (2)

3.2.2 Name TWO non-absorbent building materials. (2)

[14]

QUESTION 4

The piece of metal plate of even thickness shown in FIGURE 3 on DIAGRAM SHEET 1 (attached) has a triangular hole. The compound section is symmetrical about the Y-Y axis. ALL measurements are in millimetres.

4.1 Calculate the total area of the compound section. (5)

4.2 Determine the distance of the centroid of each section from M-M. (2)

4.3 Calculate the sum of the moments of the section about M-M. (6)

4.4 Calculate the position of the centroid of the compound section from M-M. (3)

4.5 On your own scale, redraw FIGURE 3 next to the question number (4.5) in the ANSWER BOOK and indicate the position of the centroid on the drawing. (4)

[20]

QUESTION 5

The cantilever frame shown in FIGURE 4 on DIAGRAM SHEET 2 (attached) is fixed to a wall.

5.1 On your own scale, redraw the space diagram in FIGURE 4 next to the question number (5.1) in the ANSWER BOOK and enter Bow's notation. (3)

5.2 On a suitable scale, complete the vector diagram required to analyse the forces in the members. (9)

5.3 Determine the magnitude and nature of the forces in each member of the frame and tabulate the findings neatly. (6)

[18]

QUESTION 6

6.1 Define the term *heat.* (3)

6.2 Name the THREE ways in which heat can be transferred. (3)

6.3 Name FOUR sources of heat. (4)

6.4 A copper pipe shows an increase in length of 14 mm.
A change in temperature of 78 °C was recorded.

Calculate the original length of the pipe if the coefficient of linear expansion for copper is $1,7 \times 10^{-5}$/°C. (4)

6.5 With the aid of sketches, describe any suitable experiment to prove that different metals have different coefficients of linear expansion. (6)

[20]

TOTAL: 100

DIAGRAM SHEET 1

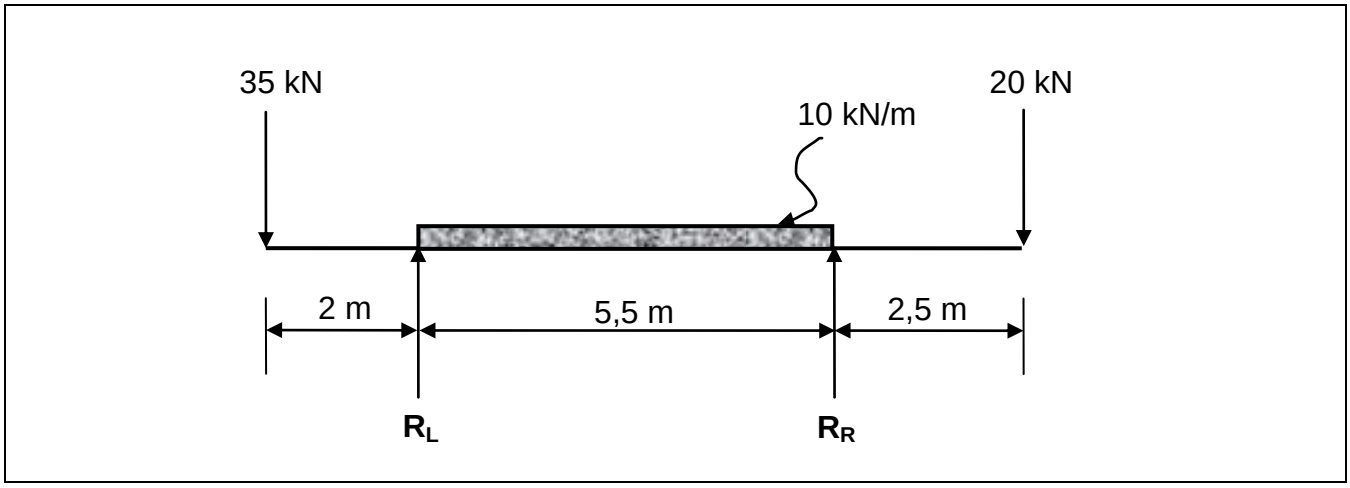

FIGURE 1

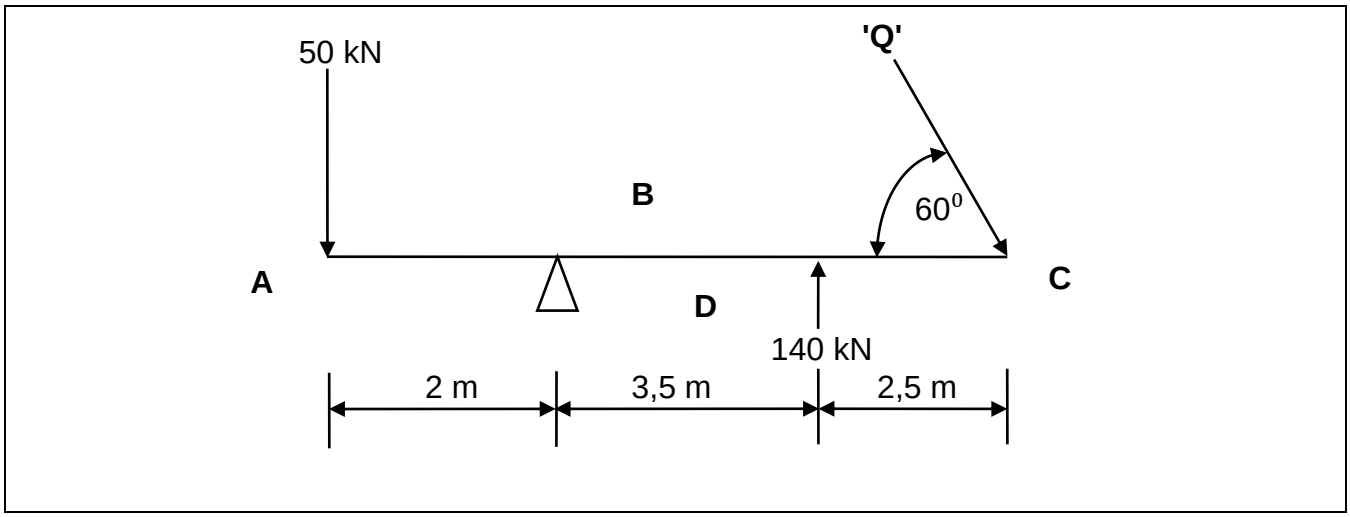

FIGURE 2

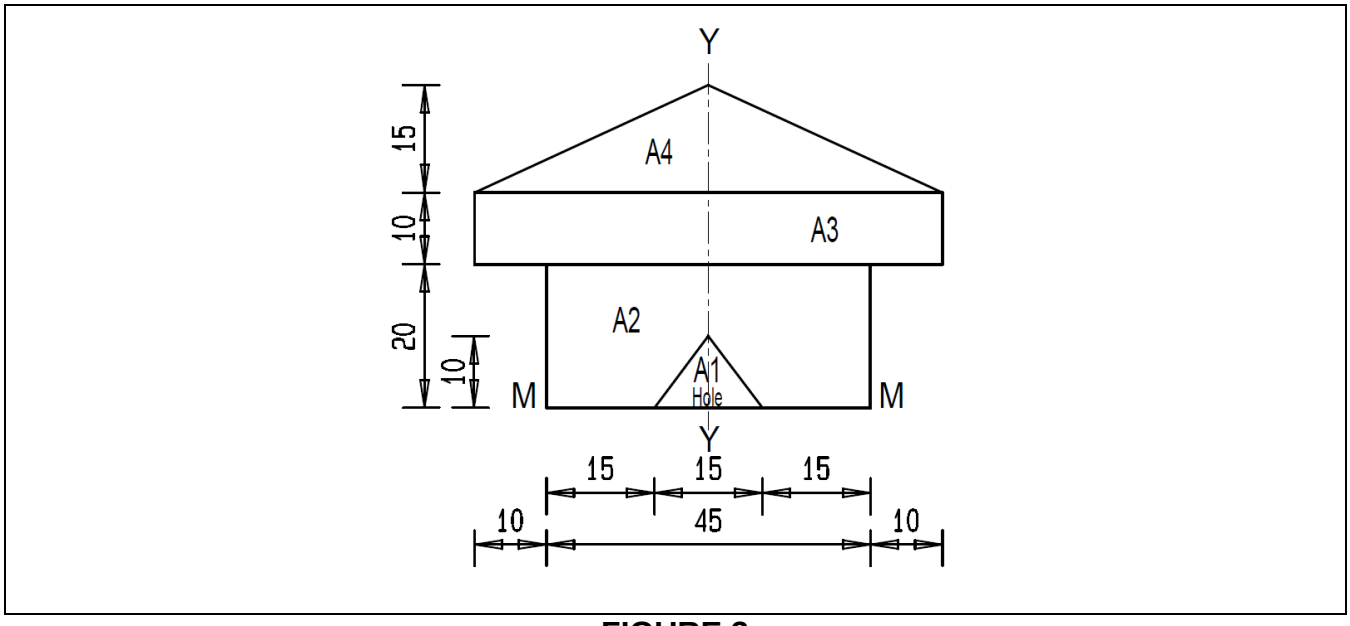

FIGURE 3

DIAGRAM SHEET 2

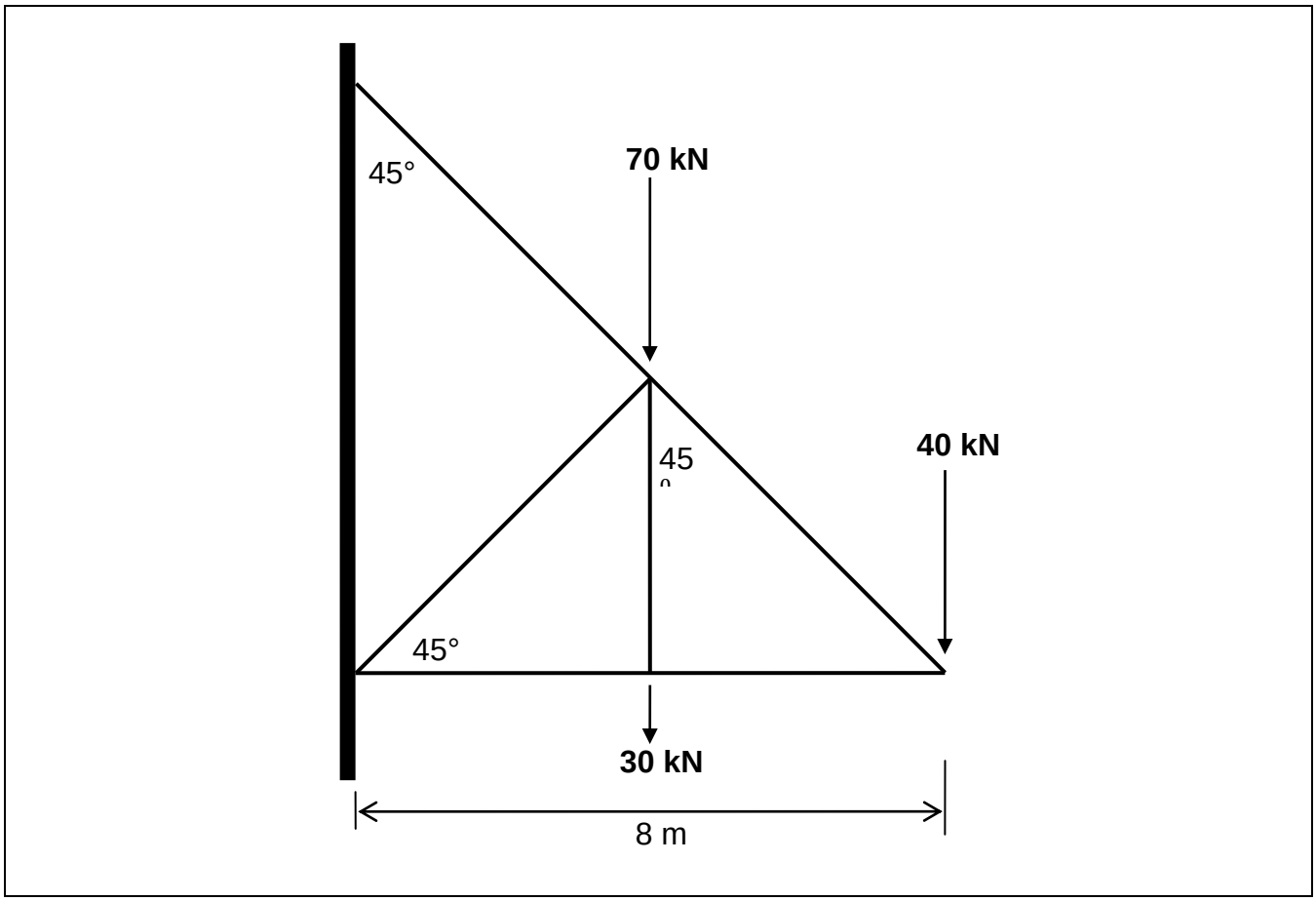

FIGURE 4

BUILDING SCIENCE N2

FORMULA SHEET

Any applicable formula may be used.

1. F =m x g
2. Sinø = O/H Sinø = T/S
3. Cosø = A/H Cosø = A/S
4. Tanø = 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. Sinø VK = W. Sinø
15. HC = W. Cosø HK = W. Cosø
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. $saturation\ coefficiant = \frac{volume\ of\ water\ absorbed}{bulk\ volume - solid\ volume}$