higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

BUILDING SCIENCE N2

(15070012)

18 November (X-paper)
09:00–12:00

Drawing instruments and nonprogrammable calculators may be used.

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

080Q1E2218

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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. Assume that 1 kg of mass exerts a force of 10 N.
5. Round off to THREE decimals.
6. Write down the formula before you do the calculations.
7. Use only a black or blue pen.
8. All sketches and diagrams must be done in pencil.
9. Write neatly and legibly.

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QUESTION 1

1.1 State the temperature at which water has its maximum density. (1)

1.2 What type of energy is required to change the state of matter? (1)

1.3 Define the following terms as found in Building Science:

1.3.1 Law of moments (3)

1.3.2 Capillary action (3)

1.3.3 Torque (3)

1.3.4 Buoyed (2)

[13]

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

[13]

QUESTION 3

3.1 State FOUR aspects that should be considered before choosing a roof covering. (4)

3.2 State 'Yes' if you agree or 'No' if you do not agree with the following statement and give TWO reasons for your answer:

Corrugated iron sheeting can be used as a roof covering in coastal areas. (3)

3.3 State what is described by each of the following:

3.3.1 The quantity of energy required to raise the temperature of any body by 1 °C .

3.3.2 The transfer of heat from particle to particle mostly in solids

3.3.3 It is the quantity of heat required to raise the temperature of 1 kg of a material by 1 °C or 1 K. (3 × 1) (3)

[10]

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QUESTION 4

A piece of metal plate of even thickness is shown in FIGURE 3, DIAGRAM SHEET 2 (attached). The compound section is symmetrical about M-M. 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 'X-X'. (4)

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

4.4 Calculate the position of the centroid of the compound section from 'X-X'. (4)

4.5 Redraw the metal plate shown in FIGURE 3, DIAGRAM SHEET 2 and show the position of the centroid, using any suitable scale. (4)

[23]

QUESTION 5

FIGURE 2, DIAGRAM SHEET 1 (attached) shows a simple supported roof truss with two supports R_L and R_R.

Use the following scales:
Linear scale 1 m = 10 mm
Force scale 1 mm = 1 kN

5.1 Redraw the space diagram and show the directions of the members (4)

5.2 Draw the vector diagram required to analyse the forces in the members. (8)

5.3 Determine the magnitude and nature of the forces in each member of the frame and tabulate the findings neatly. (11)

[23]

QUESTION 6

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

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

6.2 Calculate the magnitude and direction of force 'P'.

NOTE: No marks will be given for graphical means. (15)

[18]

TOTAL: 100

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DIAGRAM SHEET 1

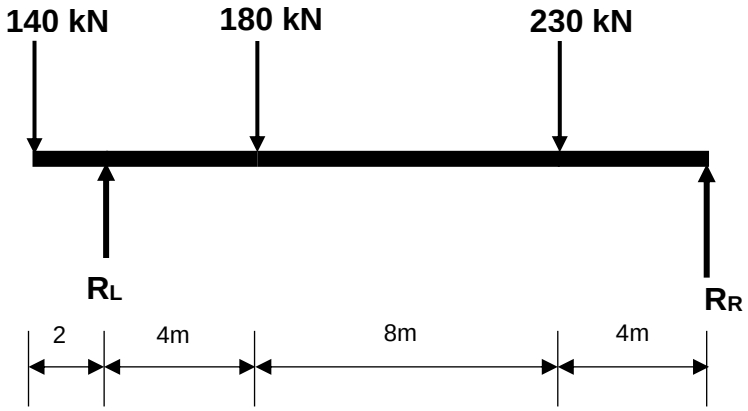


FIGURE 1

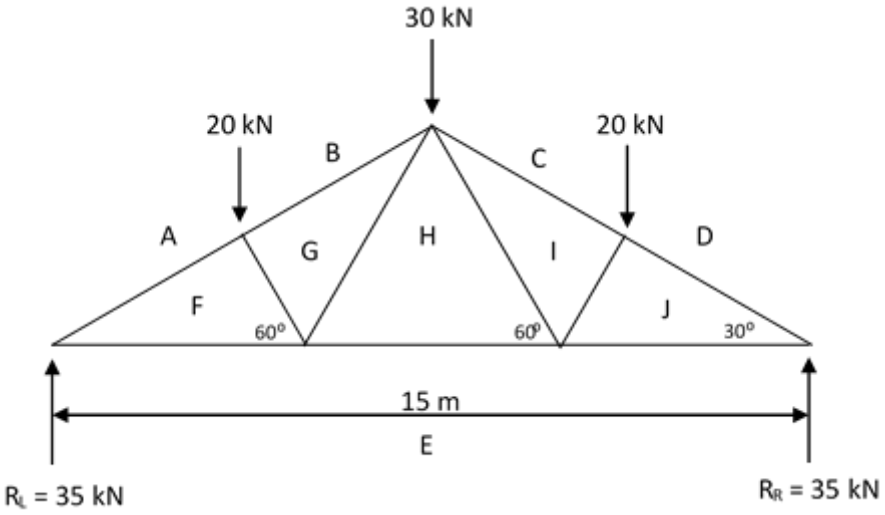


FIGURE 2

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DIAGRAM SHEET 2

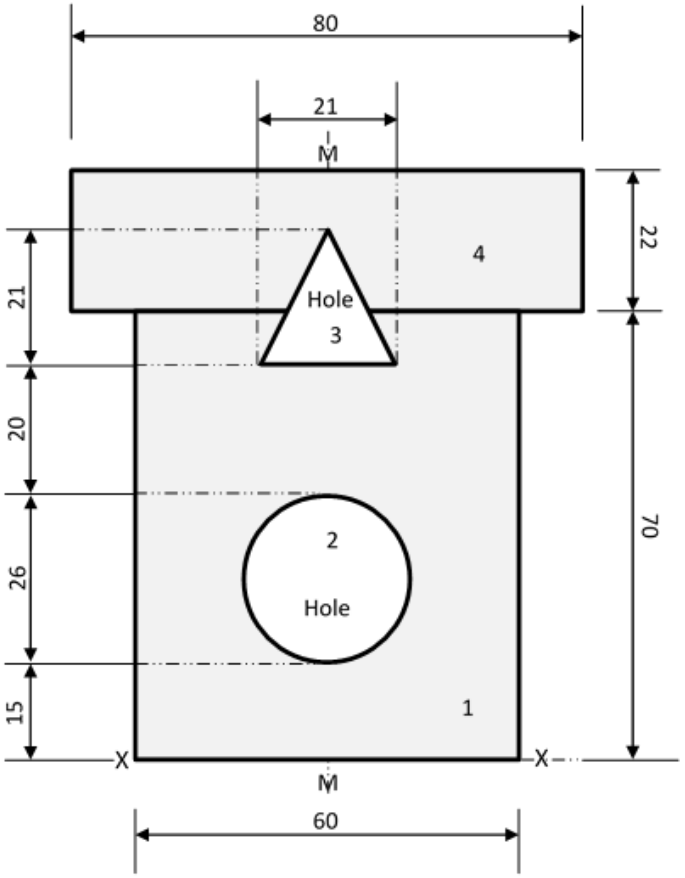


FIGURE 3

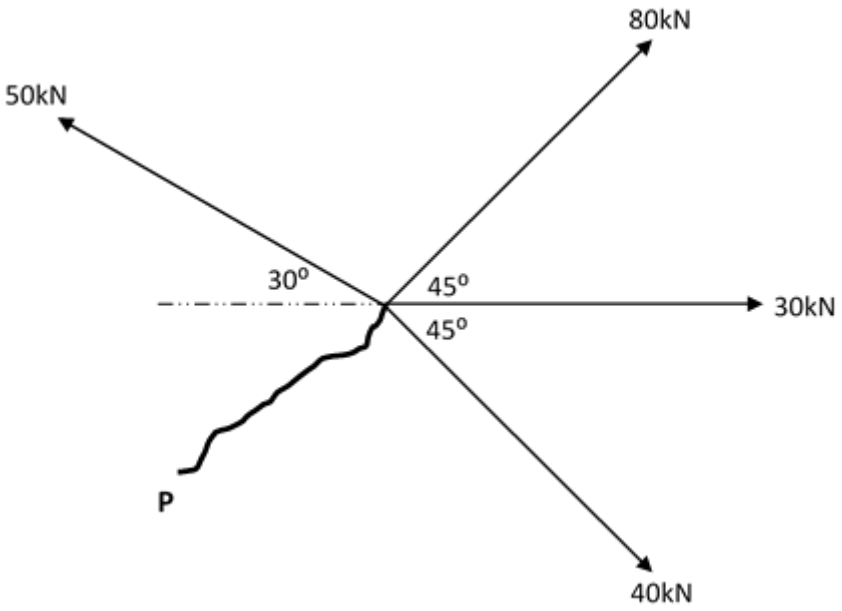


FIGURE 4

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BUILDING SCIENCE N2

FORMULA SHEET

Any applicable formula may be used.

1. F =m × 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 × H) A = ½(L × B)
7. $V = \pi \frac{D^2}{4} x\ H$
8. ∑ CM = ∑ ACM
9. ∑ ↑F = ∑ ↓F
10. V = L × B × H
11. M = F × s
12. K = C + 273
13. Moment of area = area × 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 = $m\ x\ \Delta t\ x\ SHC$

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21.

$$33\%\ porosity\ = \frac{Bulk\ volume\ -\ Solid\ volume}{Bulk\ volume}\ x\ 100\%$$

22.

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

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