higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T240**(E)**(J27)T

NATIONAL CERTIFICATE

BUILDING SCIENCE N2

(15070012)

27 July 2018 (X-Paper)
09:00–12:00

Drawing instruments and calculators may be used.

This question paper consists of 4 pages, 3 diagram sheets and a formula sheet of 2 pages.

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 drawings must be drawn to the required scale.
5. Use your own discretion where dimensions are not given.
6. ALL abbreviations and symbols must comply with the latest National Building Regulations and ALL relevant SANS (SABS) codes.
7. A balanced layout is very important and candidates will be penalised for poor planning.
8. The sketches and/or diagrams must be neat, reasonably large, in proportion and fully labelled.
9. ALL labelling must be written in capital letters.
10. ALL work you do not want to be marked must be clearly crossed out.
11. Write neatly and legibly.

QUESTION 1

1.1 Describe the purpose of roof covering. (2)

1.2 List FIVE types of roofing materials. (5)

1.3 Define the term *porosity*. (3)
[10]

QUESTION 2

2.1 Define the term *law of moment*. (3)

2.2 The beam shown in FIGURE 1, DIAGRAM SHEET 1 (attached), is held at equilibrium by the reactions R_L and R_R and supports three point loads as well as one uniformly distributed load. The total mass of the beam is 2 000 kg.

Consider the weight of the beam and:

2.2.1 Take moments about R_R to calculate the magnitude of R_L (6)

2.2.2 Take moments about R_L to calculate the magnitude of R_R (6)

2.2.3 Test the answers to prove equilibrium (2)
[17]

QUESTION 3

FIGURE 2, DIAGRAM SHEET 1 (attached), shows a roof truss in a building.

3.1 Redraw, to scale 1 : 100, the space diagram and include Bow's notation.

NOTE: Calculate the reactive forces which are not supplied. (4)

3.2 Complete the required vector diagram to a scale of 2 mm : 1 kN. (6)

3.3 Determine the nature and magnitude of each member in the framework and tabulate the results neatly. (7)
[17]

QUESTION 4

4.1 The sketch in FIGURE 3, DIAGRAM SHEET 2 (attached), shows a cross section of a structure used to support an overhead pulley system.

Calculate the position of the centre of gravity of the section from side A–A as indicated on the sketch. ALL measurements are in centimetres. Neatly tabulate the solution. (14)

4.2 Draw the space diagram in FIGURE 4, DIAGRAM SHEET 2 (attached), in the ANSWER BOOK. Complete a vector diagram to scale 1 mm = 2 kN and determine the magnitude and direction of the resultant force F. (10)
[24]

QUESTION 5

The structure shown in FIGURE 5, DIAGRAM SHEET 3 (attached), is in equilibrium.

Determine the magnitude of force F and the magnitude and direction of the reaction force at the pivot M by graphical means. Use scale 1 mm = 2 kN.

NO marks will be given for any calculations. **[15]**

QUESTION 6

6.1 Name THREE essential ingredients for a fire to start and burn. (3)

6.2 Calculate the amount of heat energy required to raise the temperature of 6 kg of iron from 200 °C to 285 °C. Assume the SHC of iron to be 0,46 kJ/kg.°C. (4)

6.3 Calculate at what temperature will the measurement 60,144 m, and a steel shaft is 60 m long at 10 °C and the coefficient of linear expansion steel is 0,000012/°C. (5)

6.4 Calculate the density of the timber, if a timber beam is 4,8 m long, 55 mm thick, 114 mm deep and has a mass of 76,5 kg. (5)
[17]

TOTAL: 100

DIAGRAM SHEET 1

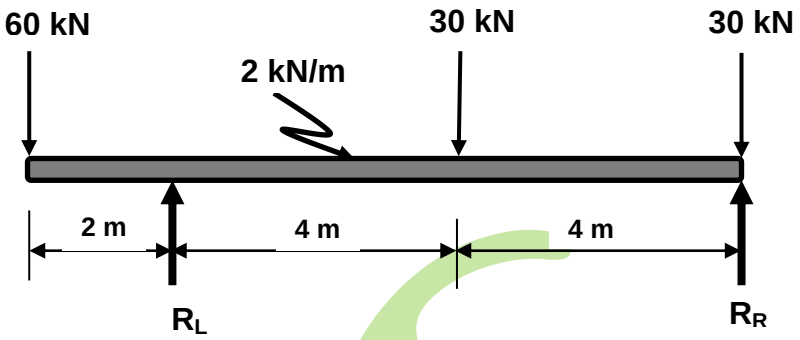

FIGURE 1

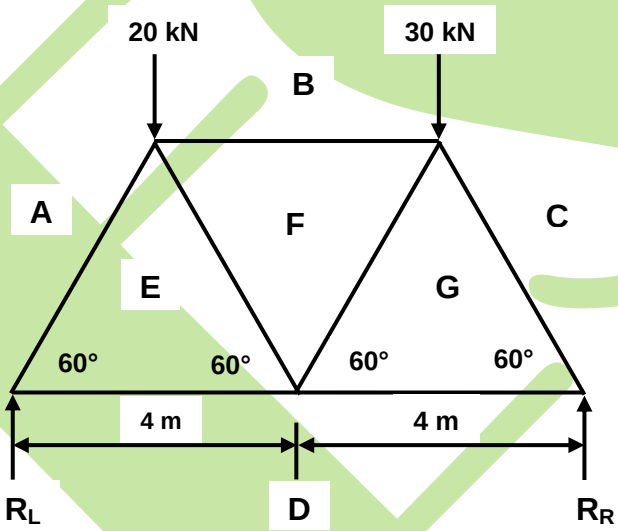

FIGURE 2

DIAGRAM SHEET 2

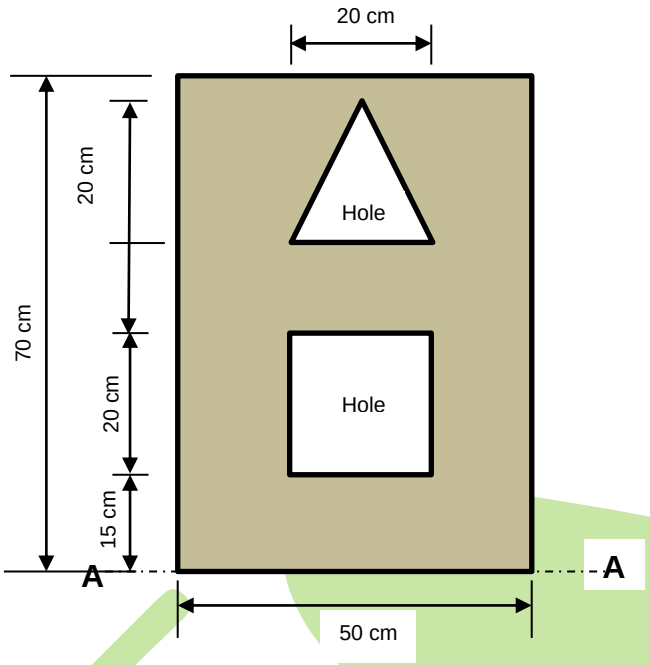

FIGURE 3

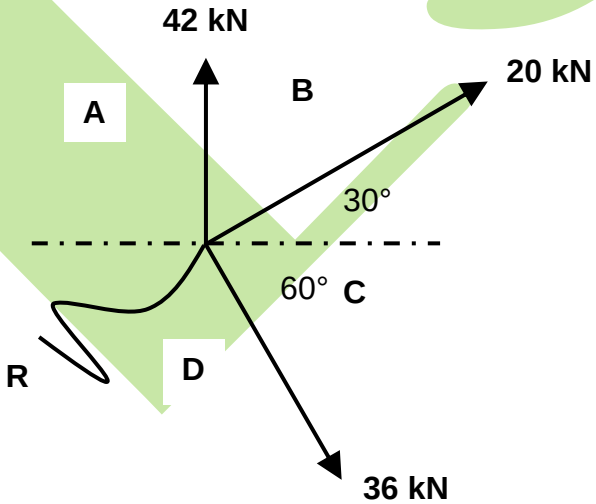

FIGURE 4

DIAGRAM SHEET 3

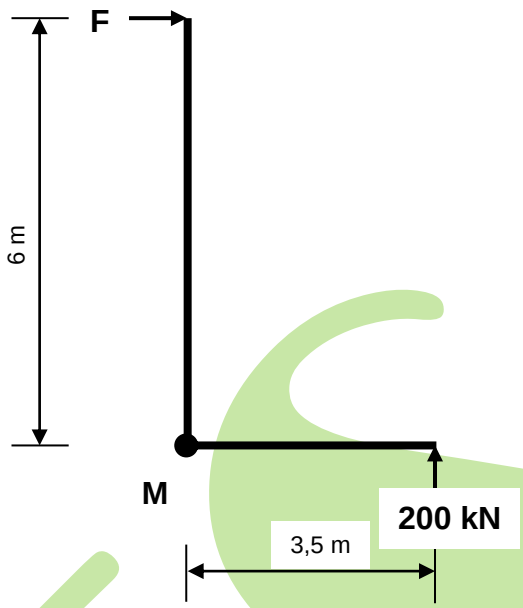

FIGURE 5

FORMULA SHEET

Any applicable formula may be used.

1. $F = m \times g$

2. $\text{Sin}\phi = O/H \qquad \text{Sin}\phi = T/S$

3. $\text{Cos}\phi = A/H \qquad \text{Cos}\phi = A/S$

4. $\text{Tan}\phi = O/A \qquad \text{Tan}\phi = T/A$

5. $A = \pi\frac{D^2}{4} = \pi r^2$

6. $A = ½(B \times H) \qquad A = ½(L \times B)$

7. $V = \pi\frac{D^2}{4} \times H$

8. $\sum CM = \sum ACM$

9. $\sum \uparrow F = \sum \downarrow F$

10. $V = L \times B \times H$

11. $M = F \times s$

12. $K = C + 273$

13. Moment of area = area × distance from axis

14. $VC = W.\text{Sin}\phi \qquad VK = W.\text{Sin}\phi$

15. $HC = W.\text{Cos}\phi \qquad HK = W.\text{Cos}\phi$

16. $y = \frac{\sum My}{\sum A}$

17. $D = \frac{M}{V}$

18. $RD = \frac{D \times S}{D \times W} = RD = \frac{M \times S}{M \times W}$

19. $\Delta L = Lo \times \Delta T \times \alpha$

20. Heat required $= m \times \Delta t \times SHC$

21. $$\%\ \text{porosity} = \frac{\text{bulk volume} - \text{solid volume}}{\text{bulk volume}} \times 100\%$$

22. $$\text{saturation coefficient} = \frac{\text{volume of water absorbed}}{\text{bulk volume} - \text{solid volume}}$$